

# MCS<sup>®</sup> Tools Handbook

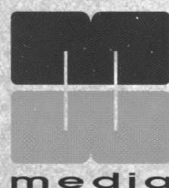
3rd Edition, 1995

MCS<sup>®</sup> 251 architecture

MCS<sup>®</sup> 51 architecture

MCS<sup>®</sup> 96 architecture

80C186 architecture



272326-003

# 80C196

## In-Circuit Emulators

Microsoft Windows 3.1 based user interface

Pull-down Menus

Speed bar (point and click)

On line help

Watch Window for high level variables

Source Window

Call Stack Window

Inspect Window



Disassembler, in-line assembler Window

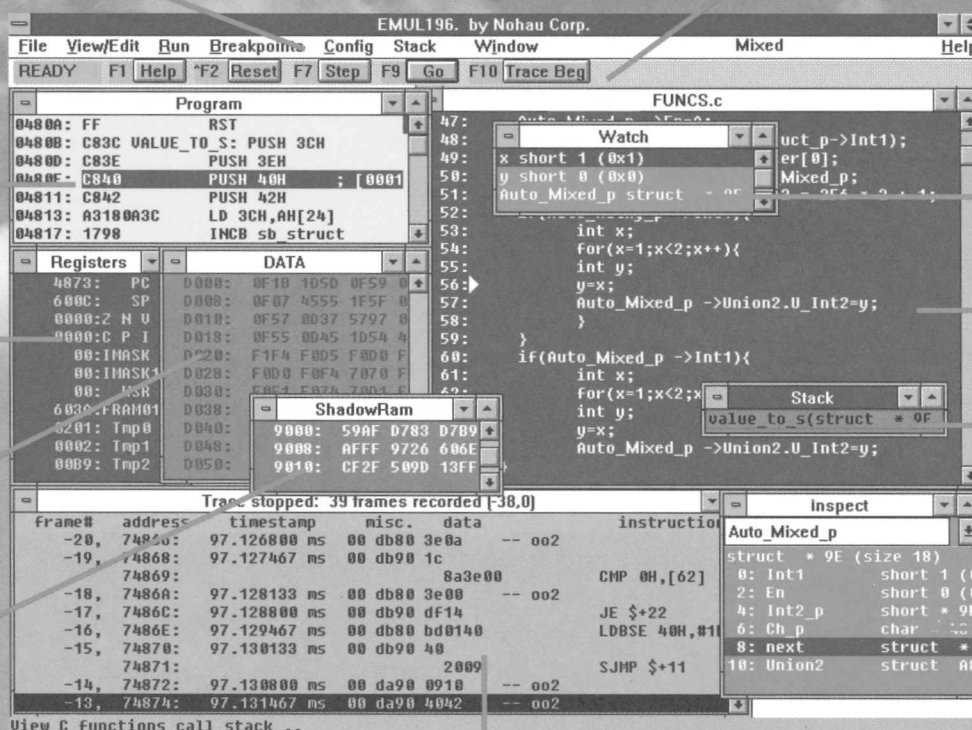
Register Window

Data Window

Shadow RAM shows data changes in real-time

Context sensitive help line

Trace Buffer Window



### FEATURES:

- Support for 80C196: KR/Q/T/C/D, JR/Q, NQ/T & more.
- Real-time emulation at maximum chip speeds.
- Use of bond-out chips for accurate emulation.
- Hosted on PC's and workstations.
- High Level support for popular C-compilers.
- Unlimited hardware breakpoints.
- Break in real-time on Internal Access, both on data value and address.
- Trace board up to 512K deep, 104 bits wide, with 40 bit timestamp. Triggering and filtering with full instruction queue decoding.
- Memory contents shown during real-time emulation (Shadow RAM).
- Code Coverage and Program Performance Analysis.
- CCB's controlled from user interface. (Wait states, timing mode, bus width and more.)

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To Embedded System Developers:

Welcome to the third edition of Intel's MCS® Tools Handbook featuring MCS® 251, MCS® 51 and MCS® 96 microcontrollers and 80C186 embedded processors. This Handbook is the result of a joint effort between Intel Embedded Microcomputer Division, MW Media, and over 50 suppliers of hardware and software development tools, products and services.

The purpose of the MCS® Tools Handbook is to provide a single, complete reference source of solutions for the embedded systems developer. It includes product descriptions and contact information for over 120 products from 56 companies. In addition to the MCS® 251, MCS® 51, and MCS® 96 microcontrollers and 80C186 embedded processors, you will find in the Handbook: peripheral components, prototyping boards, emulators, logic analyzers, programmers, compilers, assemblers, simulators, debugging tools, code analyzers, and real-time operating systems. You can also request additional information about the products and services listed here either by contacting the suppliers directly or by completing and returning the enclosed Subscription Form.

Because we are committed to making this Handbook as complete and accurate as possible, we sincerely hope it aids your discovery of the products you need to complete your project quickly and efficiently. Your comments and suggestions to improve it are most welcome.

Thank you for your interest in Intel's families of microcontrollers and the solutions that support them. The MCS® Tools solutions—more good reasons Intel keeps you one design ahead.

A handwritten signature in black ink, appearing to read "M. Hudson".

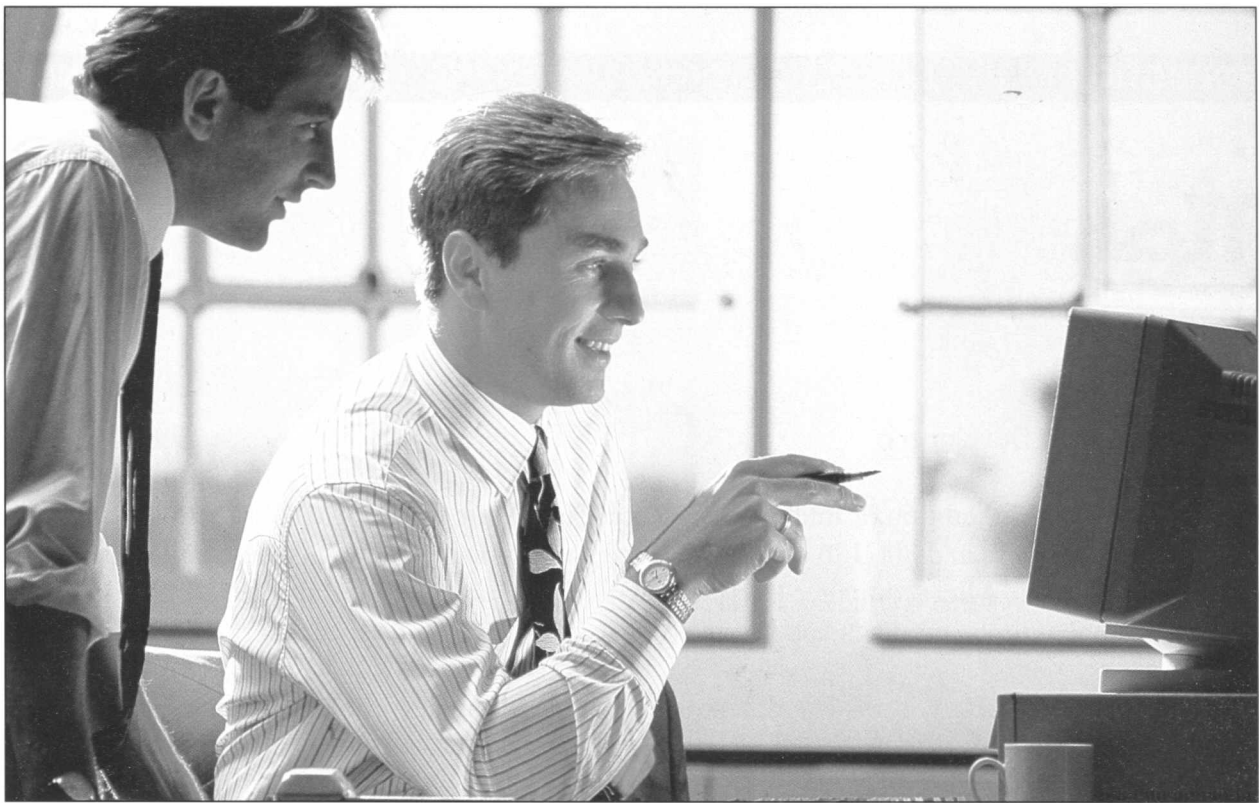
Marlene Hudson  
Development Tools Manager  
Intel Embedded Microcontroller Division

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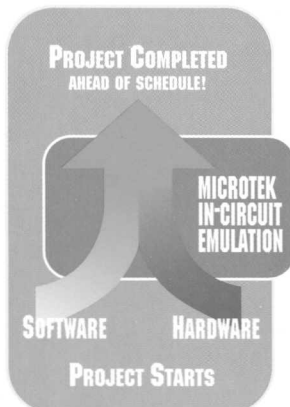
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COMPANY	PRODUCT	MCS® 51	MCS® 251	MCS® 96	80C186	PG.
		ARCHITECTURES				
Microcontrollers & Microprocessors						
Intel Corporation	MCS® 51 Microcontroller Family	X	X			12
Intel Corporation	MCS® 251 Microcontroller Family		X			13
Intel Corporation	MCS® 51 & MCS® 251					
	Microcontroller Components	X	X			14-15
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Intel Corporation	MCS® 96 Microcontroller Family Components			X		17
Intel Corporation	80C196NU Microcontroller			X		18-19
Intel Corporation	87C196CA Microcontroller with CAN 2.0			X		20-21
Intel Corporation	80186/80C186 Embedded Processors				X	22-23
Peripherals & Accessories						
AMCC	Multi-Frequency Clock Drivers/Generators	X	X	X	X	24
AMCC	Matchmaker Controllers	X	X	X	X	25
EDI Corporation	Modular R&D Interconnect System	X	X	X	X	26
Emulation Technology	Emulator Adapters, Test Clips, & Accessories			X	X	27
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*Intel MCS® 251 and MCS® 51 Architectures (Article)*

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COMPANY	PRODUCT	MCS® 51	MCS® 251	MCS® 96	80C186	PG.
ARCHITECTURES						
Software Development Tools						
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BSO/TASKING	MCS® 251 Microcontroller Dev. Solution		X			39
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Data I/O	PSX 500/1000 Parallel Programmers	X	X	X		48
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COMPANY	PRODUCT	MCS® 51	MCS® 251	MCS® 96	80C186	PG.
		ARCHITECTURES				
Software Development Tools						
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BSO/TASKING	CrossView 8051 Debugger	X				57
BSO/TASKING	8051 Assembler	X				58
ChipTools	ChipView-51 High/Low-Level Debugger	X				59
Chronology	TimingDesigner	X	X	X	X	60

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COMPANY	PRODUCT	MCS® 51	MCS® 251	MCS® 96	80C186	PG.
		ARCHITECTURES				
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Franklin Software	BL51 CODE Banking Linker	X	X			63
Franklin Software	RTX51 Real Time Operating Systems	X	X			64
Franklin Software	DS51 Source Level Debugger/Simulator	X	X			65
Franklin Software	8051-DriveWay Code Generation Tool	X				66
Franklin Software	MCS® 51, MCS® 251 Microcontroller Software Development Tools	X	X			67-68
Franklin Software	ProView Turbo Tools	X	X			69-70
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Franklin Software	PK51 Professional Developers Kit	X	X			73
Franklin Software	C51 C Language Compiler	X	X			74
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Micro Computer Control	MICRO/C-51™ 8051 C Compiler Kit	X				78
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Hardware Development Tools						
Advin Systems	PILOT-U40 Universal Programmer	X		X		81
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BSO/TASKING	ChipView-196 Debugger			X		104
BSO/TASKING	196 Assembler			X		105
ChipTools	ChipView-196 High-Level/Low-Level Debugger			X		106
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ARCHITECTURES								
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Inform Software	fuzzyTECH	Fuzzy Logic Development System		X		X		109
Intel Corporation	Project Builder	196				X		110
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BYTEK	87C196	Special Support Package		X		X		113
CheckMate Systems	CheckMate II-C196K	Emulator				X		114
iSYSTEM	iC196	Power Emulator				X		115
Lauterbach Datentechnik	TRACE32	In-Circuit Emulator				X		116
Nohau Corporation	EMUL196-PC	In-Circuit Emulator				X		117-19
Orion Instruments	8800	Emulator/Analyzer				X		120
Signum Systems	USP-96, USE-96NT	In-Circuit Emulator		X		X	X	121
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ARCHITECTURES						
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Concurrent Sciences	Soft-Scope Remote Target Debugger				X	129
DDC-I	DACS-80x86 Compilers/Debuggers			X	X	130
Innovage Technologies	Docuboard™				X	131
KADAK Products	AMX™86 Real-Time Multitasking Kernel				X	132
Paradigm Systems	Paradigm C/C++ PowerPak				X	133
Systems & Software	OMF/CV/SP/Tools and SoftProbe for Windows				X	134
Tektronix	32GPX and 32DM06, TLA510 and 92DM06A				X	135
US Software	SuperTask! RTOS Suite	X		X	X	136
US Software	USNET Networking	X		X	X	137
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Applied Microsystems	CodeTAP-XA In-Circuit Emulators				X	138-39
Ceibo	DS-186 In-Circuit Emulator				X	140
CheckMate Systems	CheckMate-C186/88 Emulators			X	X	141
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## TRADEMARKS & COPYRIGHTS

Archimedes: SimCASE  
BSO/TASKING: CrossView

BYTEK Corporation: BYTEK, EZ-WRITER XT,  
FIREMAN 8X, MULTI PROGRAMMER

CheckMate Systems: CheckMate, CheckMate II-  
C196K, CheckMate-C186/88

Chronology Corporation: TimingDesigner, Chronology

CMX Company: CMX-RTX, CMX-TINY, CMX-TINY+

Concurrent Sciences: Soft-Scope

Data I/O: TaskLink, ProMaster, PSXPRO, PSX,

PSX400, PSX1000, Mlink, MatchBook, ABEL

DDC-I: DACS

Embedded System Products: RTX

Emulation Technology: PQFP Clip, Adapt-A-Pod,  
Adapt-A-Clip

Franklin Software: DriveWay, BL51, RTX51, DS51,  
C51, A51, dScope51, Turbo View

Industrial Programming: MTOS

Inform Software Corporation: fuzzyTECH

Innovage Technologies: Docuboard, QuickTrace

International Business Machines: IBM

Intel Corporation: MCS, MCS 51, MCS 251, MCS  
96, 80C186, Intel 386, Intel 486, Pentium, ApBuilder,  
Project Builder, iRMX

JMI: C EXECUTIVE

KADAK Products Ltd.: AMX86

Metalink Corporation: Metalink, iceMASTER-SC,

iceMASTER-AA, iceMASTER-PE

Micro Computer Control: MICRO/C-51

Microsoft Corporation: Microsoft, Windows,  
MS-Windows

Nohau Corporation: EMUL51-PC, EMUL-251PC

Orion Instruments: Clip-On Emulation

Paradigm: DEBUG

Production Languages: PLC, COMPASS51,  
COMPASS 251,

RAMTEX A/S: STINGATE

Simucad: SILOSIII

U S Software: SuperTask!, USNET

WSI, Inc.: PSDSoft,

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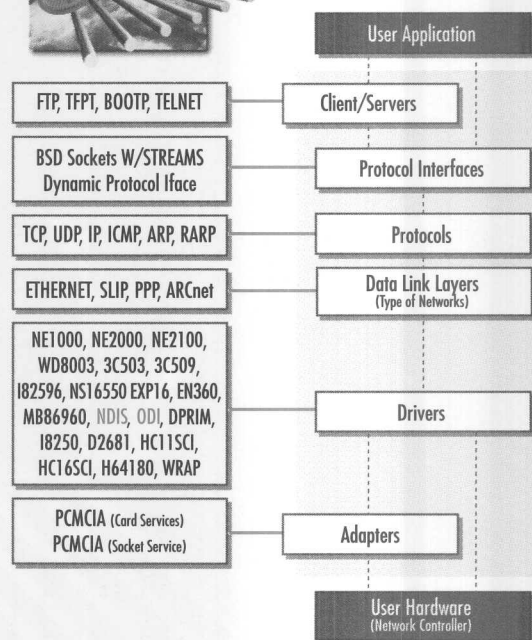
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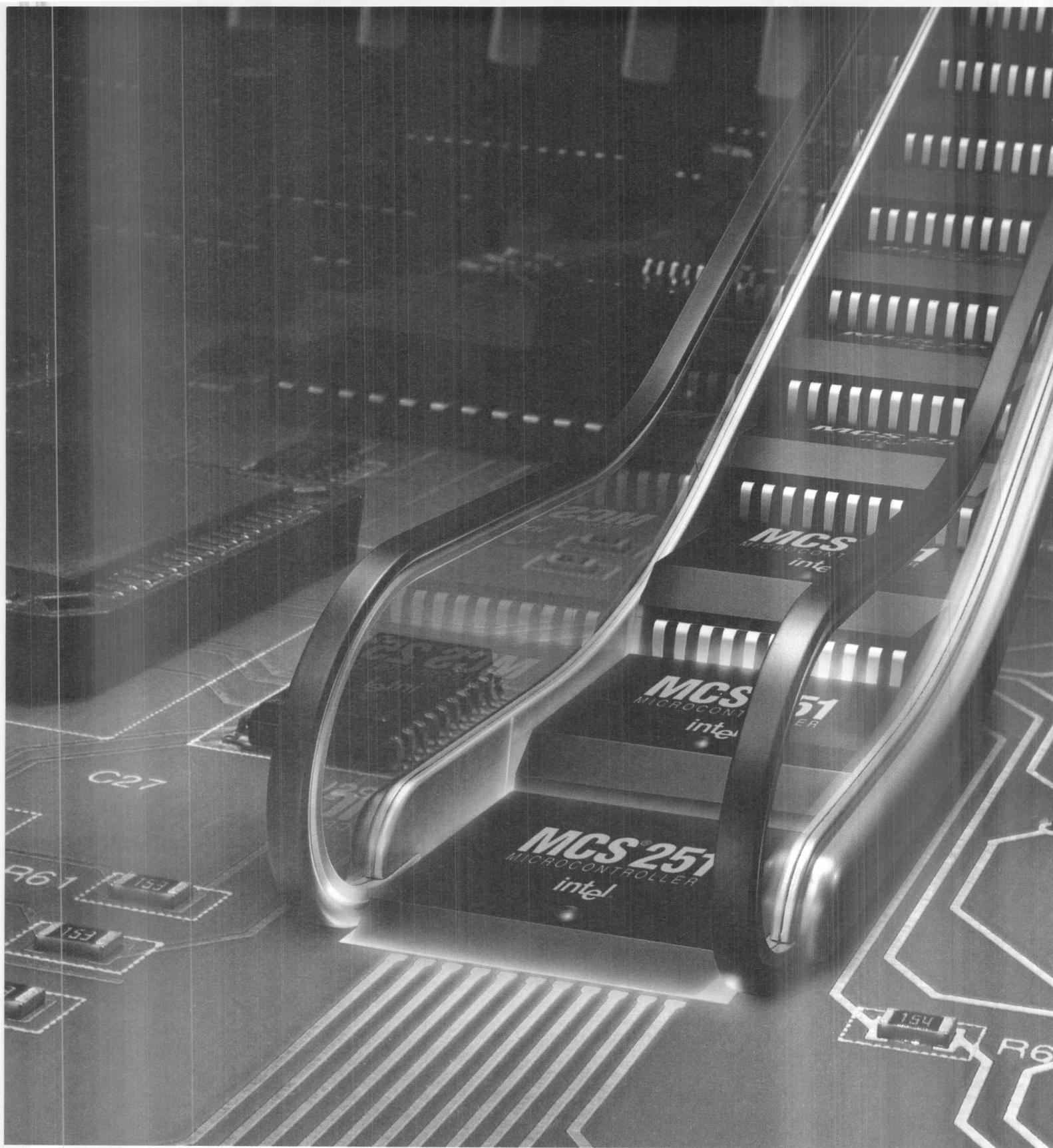


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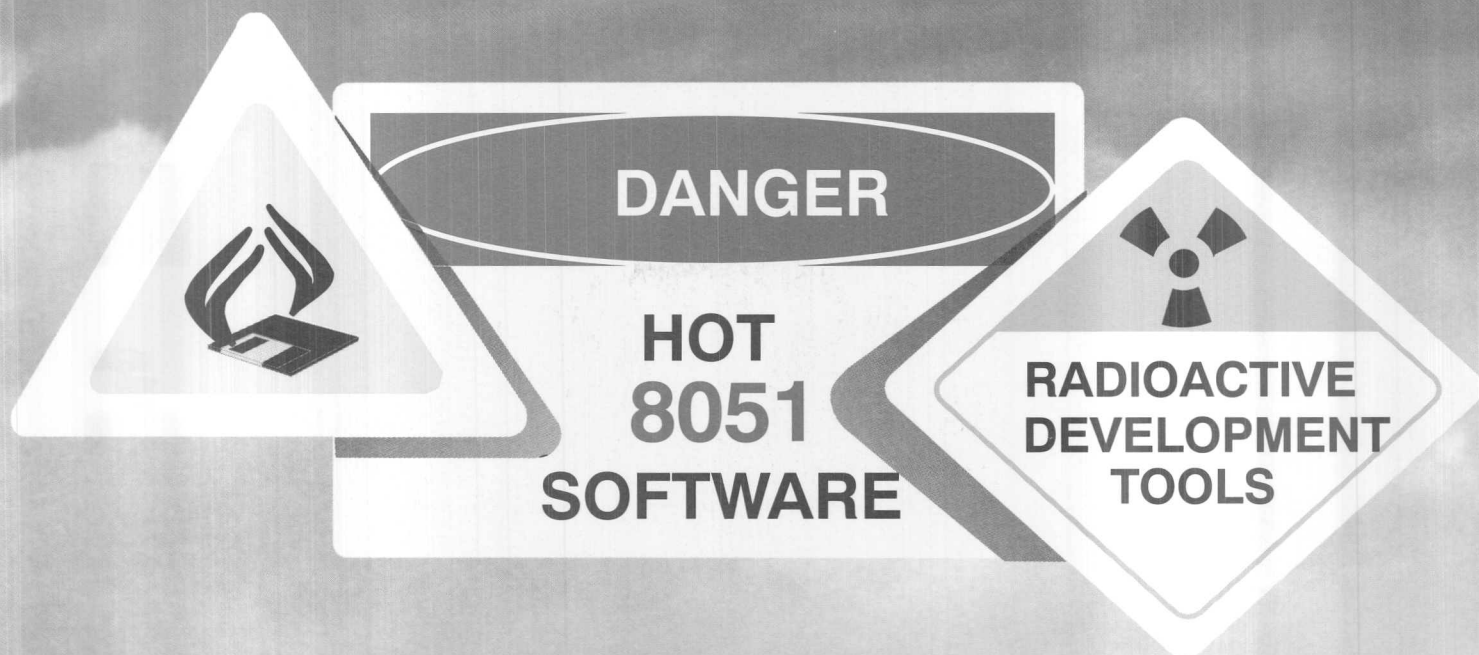


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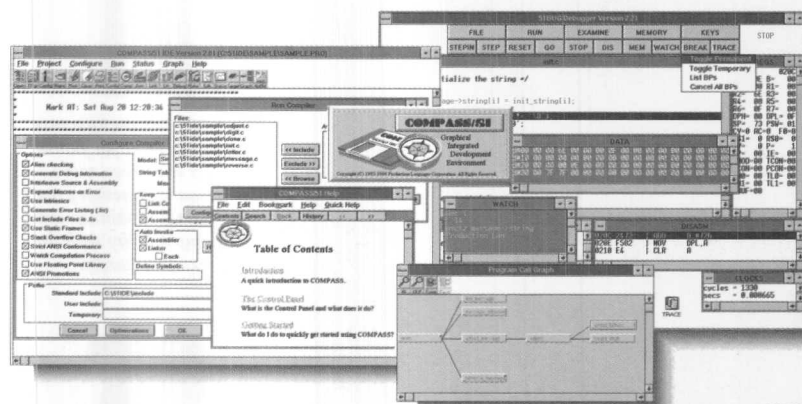
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# Section I

## Microcontrollers, Microprocessors & Peripherals

COMPANY	PRODUCT	MCS® 51	MCS® 251	MCS® 96	80C186	PG.
		ARCHITECTURES				
Microcontrollers & Microprocessors						
Intel Corporation	MCS® 51 Microcontroller Family	X	X			12
Intel Corporation	MCS® 251 Microcontroller Family		X			13
Intel Corporation	MCS® 51 & MCS® 251 Microcontroller Components	X	X			14-15
Intel Corporation	MCS® 96 Microcontroller Family			X		16
Intel Corporation	MCS® 96 Microcontroller Family Components			X		17
Intel Corporation	80C196NU Microcontroller			X		18-19
Intel Corporation	87C196CA Microcontroller with CAN 2.0			X		20-21
Intel Corporation	80186/80C186 Embedded Processors				X	22-23
Peripherals & Accessories						
AMCC	Multi-Frequency Clock Drivers/Generators	X	X	X	X	24
AMCC	Matchmaker Controllers	X	X	X	X	25
EDI Corporation	Modular R&D Interconnect System	X	X	X	X	26
Emulation Technology	Emulator Adapters, Test Clips, & Accessories			X	X	27
WSI, Inc.	PSD Programmable Microcontroller Peripherals	X		X	X	28
WSI, Inc	PSDSOFT Development Tools for Peripherals	X		X	X	29



MCS<sup>®</sup> 51 Architecture

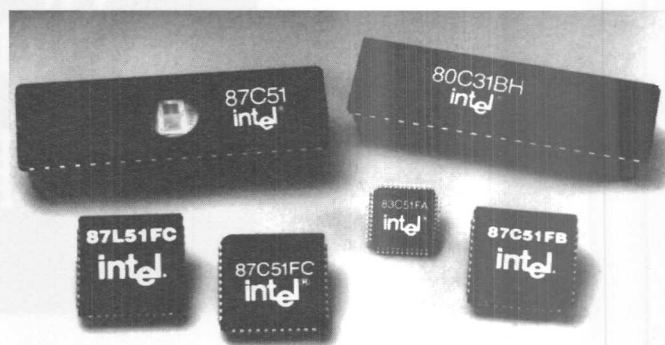
## Intel MCS<sup>®</sup> 51 Microcontroller Family

### Key Features

- ▲ Key features of the MCS<sup>®</sup> 51 microcontroller family which make it popular for embedded control are:
  - 8-bit CPU optimized for control applications
  - Extensive Boolean processing (single bit) capabilities
- ▲ 64K Program Memory address space
- ▲ 64K Data Memory address space
- ▲ On chip Program Memory (up to 32K Bytes)
- ▲ On chip Data RAM (Up to 512 bytes)
- ▲ Bidirectional and individually addressable I/O lines
- ▲ Full duplex UART

### Benefits

- ▲ Efficient event control design
- ▲ Easy and simple bit manipulation
- ▲ Enables single chip designs
- ▲ High integration enables low cost and low chip count designs
- ▲ Simplifies your design cycle



### Target Applications

Telephone Answering Machines  
 Notebook/PC Keyboards  
 Digitizers  
 Hard Disk Drives  
 Tape Backup Systems  
 Television/VCR/Camcorders  
 Cellular Telephones  
 Appliance Controller Panels  
 Security Systems  
 Motor Control  
 Anti-Lock Brakes  
 Fax/Modems  
 Pen-based PC  
 Medical Instrumentation

### Product Family

8X51	8XC51JA
8X51AH	8XC51JB
8X51BX	8XC51JC
8052	8XC51SL
8XC32	8XC51SLAL
8XC152JA	8XC51SLAH
8XC152JB	
8XC51	8XL51FA
8XC51FA	8XL51FB
8XC51FB	8XL51FC
8XC51FC	8XL52
8XC51RA	8XL54
8XC51RB	8XL58
8XC51RC	
8XC52	
8XC54	
8XC58	
8XC51GB	

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MCS<sup>®</sup> 251 Architecture

# Intel MCS<sup>®</sup> 251 Microcontroller Family

## Features

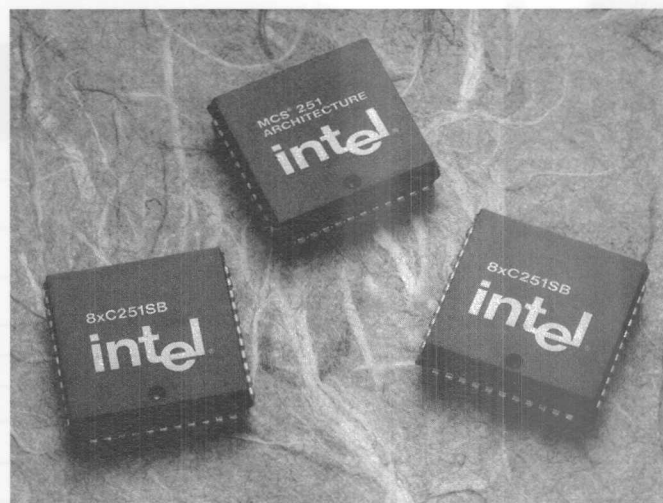
- ▲ MCS<sup>®</sup> 251 architecture core
- ▲ Binary code and pin compatible with MCS<sup>®</sup> 51 microcontroller
- ▲ 1K on-chip data RAM
- ▲ 16K on-chip OTP, ROM or ROMless versions supported
- ▲ Programmable Counter Array (PCA) supports
  - Real-time capture and compare
  - High speed output
  - PWM
- ▲ Hardware watchdog timer
- ▲ Page mode configuration
- ▲ 0 or 1 wait state configuration for external memory access

## Benefits

- ▲ 5X to 15X performance increase compared to MCS<sup>®</sup> 51 microcontrollers at the same clock speed. Direct "drop-in" replacement in current applications to achieve performance boost
- ▲ Software investment protected
- ▲ Minimal development cost and effort required
- ▲ Quick time to market and quick time to money

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- ▲ Increased internal memory capacity for data manipulation and C language support
- ▲ Flexibility in using different memory options in development and production development and production
- ▲ Flexibility and performance enhancement in real-time control applications such as:
  - Measurement of duty cycle, phase difference and frequency
  - Real-time interrupt generation and output toggling
  - Adjustable duty cycle generation
- ▲ Increased system reliability
- ▲ Increases the performance for external instruction fetch by 2X
- ▲ Flexibility in external memory and peripheral interface
  - Allows the use of either fast or slow memory

## Target Applications

Printers  
Copiers  
Scanners  
CD ROM drives  
Tape drives  
POS terminal  
Modems  
Digital phones  
Cellular/wireless handsets  
Linecards

## Product Family

8XC251SB

# MCS<sup>®</sup> 51 and MCS<sup>®</sup> 251 Microcontroller Family Components

DEVICE	ROM EPROM (bytes)	Register RAM (bytes)	Timer Counters	Serial Port	Analog Input Channels	I/O Pins	Speed (MHz)	Process	Pkg	Security	Key Features
<b>MCS<sup>®</sup> 251 Microcontroller New Architecture</b>											
80C251SB	ROMLESS	1K	3	1	0	32	12,16	CHMOS	N, P*	L3	High Performance MCS251 Architecture, PCA, H/W WDT
83C251SB	16K ROM	1K	3	1	0	32	12,16	CHMOS	N, P*	L3	High Performance MCS251 Architecture, PCA, H/W WDT
87C251SB	16K OTP	1K	3	1	0	32	12,16	CHMOS	N, P*	L3	High Performance MCS251 Architecture, PCA, H/W WDT
80C31BH	ROMLESS	128	2	1	0	32	12,16,20,24,33	CHMOS	D, N, P, S	N/A	Power Save Modes
80C51BH	4K ROM	128	2	1	0	32	12,16,20,24,33	CHMOS	D, N, P, S	P	Power Save Modes
87C51	4K EPROM	128	2	1	0	32	12,16,20,24,33	CHMOS	D, N, P, S	L3	Three Level Memory Lock
<b>MCS<sup>®</sup> 51 Microcontroller Classic</b>											
80C32	ROMLESS	256	3	1	0	2	2,16,20,24,33	H MOS	N, P, S	N/A	Up-Down Timer/Counter
80C52	8K ROM	256	3	1	0	32	12,16,20,24,33	CHMOS	N, P, S	L1	Up-Down Timer/Counter
87C52	8K EPROM	256	3	1	0	32	12,16,20,24,33	CHMOS	D, N, P, S	L3	Up-Down Timer/Counter
80C54	ROMLESS	256	3	1	0	32	12,16,20,24,33	CHMOS	N, P, S	L1	Up-Down Timer/Counter
87C54	16K EPROM	256	3	1	0	32	12,16,20,24,33	CHMOS	D, N, P, S	L3	Up-Down Timer/Counter
80C58	ROMLESS	256	3	1	0	32	12,16,20,24,33	CHMOS	N, P, S	L1	Up-Down Timer/Counter
87C58	32K EPROM	256	3	1	0	32	12,16,20,24,33	CHMOS	D, N, P, S	L3	Up-Down Timer/Counter
80C51FA	ROMLESS	256	3	1	0	32	12,16,20,24,33	CHMOS	N, P, S	N/A	Programmable Counter Array (PCA), Prog. Clock out
83C51FA	8K ROM	256	3	1	0	32	12,16,20,24,33	CHMOS	N, P, S	L1	Programmable Counter Array (PCA), Prog. Clock out
87C51FA	8K EPROM	256	3	1	0	32	12,16,20,24,33	CHMOS	D, N, P, S	L3	Programmable Counter Array (PCA), Prog. Clock out
83C51FB	16K ROM	256	3	1	0	32	12,16,20,24,33	CHMOS	N, P, S	L1	Programmable Counter Array (PCA), Prog. Clock out
87C51FB	16K EPROM	256	3	1	0	32	12,16,20,24,33	CHMOS	D, N, P, S	L3	Programmable Counter Array (PCA), Prog. Clock out
83C51FC	32K ROM	256	3	1	0	32	12,16,20,24,33	CHMOS	P, S	L1	Programmable Counter Array (PCA), Prog. Clock out
87C51FC	32K EPROM	256	3	1	0	32	12,16,20,24,33	CHMOS	D, N, P, S	L3	Programmable Counter Array (PCA), Prog. Clock out
<b>MCS<sup>®</sup> 51 Microcontroller Low Voltage</b>											
80L52	8K ROM	256	3	1	0	32	12,16,20*	CHMOS	N, S	L1	Low Voltage, Up-Down Timer/Counter
87L52	8K OTP	256	3	1	0	32	12,16,20*	CHMOS	N, S	L3	Low Voltage, Up-Down Timer/Counter
80L54	ROMLESS	256	3	1	0	32	12,16,20*	CHMOS	N, S	L1	Low Voltage, Up-Down Timer/Counter
87L54	16K OTP	256	3	1	0	32	12,16,20*	CHMOS	N, S	L3	Low Voltage, Up-Down Timer/Counter
80L58	ROMLESS	256	3	1	0	32	12,16,20*	CHMOS	N, S	L1	Low Voltage, Up-Down Timer/Counter
87L58	32K OTP	256	3	1	0	32	12,16,20*	CHMOS	N, S	L3	Low Voltage, Up-Down Timer/Counter
80L51FA	8K ROM	256	3	1	0	32	12,16,20*	CHMOS	N, S	L1	Low Voltage, PCA, Prog. Clock out
87L51FA	8K OTP	256	3	1	0	32	12,16,20*	CHMOS	N, S	L3	Low Voltage, PCA, Prog. Clock out
80L51FB	ROMLESS	256	3	1	0	32	12,16,20*	CHMOS	N, S	L1	Low Voltage, PCA, Prog. Clock out



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# MCS<sup>®</sup> 51 and MCS<sup>®</sup> 251

## Microcontroller Family Components

DEVICE	ROM EPROM (bytes)	Register RAM (bytes)	Timer Counters	Serial Port	Analog Input Channels	I/O Pins	Speed (MHz)	Process	Pkg	Security	Key Features
<b>MCS<sup>®</sup> 51 Microcontroller Low Voltage</b> (continued)											
87L51FB	16K OTP	256	3	1	0	32	12,16,20*	CHMOS	N, S	L3	Low Voltage, PCA, Prog. Clock out
80L51FC	ROMLESS	256	3	1	0	32	12,16,20*	CHMOS	N, S	L1	Low Voltage, PCA, Prog. Clock out
87L51FC	32K OTP	256	3	1	0	32	12,16,20*	CHMOS	N, S	L3	Low Voltage, PCA, Prog. Clock out
<b>MCS<sup>®</sup> 51 Microcontroller Expanded RAM</b>											
80C51RA	ROMLESS	512	3	1	0	32	12,16,20,24	CHMOS	N, P	N/A	Expanded RAM, Prog. Clock Out, H/W WDT
83C51RA	8K ROM	512	3	1	0	32	2,16,20,24	CHMOS	N, P	L1	Expanded RAM, Prog. Clock Out, H/W WDT
87C51RA	8K EPROM	512	3	1	0	32	12,16,20,24	CHMOS	N, P	L3	Expanded RAM, Prog. Clock Out, H/W WDT
83C51RB	16K ROM	512	3	1	0	32	12,16,20,24	CHMOS	N, P	L1	Expanded RAM, Prog. Clock Out, H/W WDT
87C51RB	16K EPROM	512	3	1	0	32	12,16,20,24	CHMOS	N, P	L3	Expanded RAM, Prog. Clock Out, H/W WDT
83C51RC	32K ROM	512	3	1	0	32	12,16,20,24	CHMOS	N, P	L1	Expanded RAM, Prog. Clock Out, H/W WDT
87C51RC	32K EPROM	512	3	1	0	32	12,16,20,24	CHMOS	N, P	L3	Expanded RAM, Prog. Clock Out, H/W WDT
<b>MCS<sup>®</sup> 51 Microcontroller Application Specific</b>											
80C51GB	ROMLESS	256	3	1+SEP	8	48	12,16	CHMOS	N1	N/A	8 Channel 8-bit A/D, 2 PCA, 6 I/O Ports
83C51GB	8K ROM	256	3	1+SEP	8	48	12,16	CHMOS	N1	L1	8 Channel 8-bit A/D, 2 PCA, 6 I/O Ports
87C51GB	8K OTP	256	3	1+SEP	8	48	12,16	CHMOS	N1	L3	8 Channel 8-bit A/D, 2 PCA, 6 I/O Ports
80C152JA	ROMLESS	256	2	1	0	40	12,16.5	CHMOS	P1, N1	N/A	Multi-Protocol Serial Communication, Power Save Modes
80C152JB	ROMLESS	256	2	1	0	56	12,16.5	CHMOS	N1	N/A	Multi-Protocol Serial Communication, Power Save Modes
83C152JA	8K ROM	256	2	1	0	40	12,16.5	CHMOS	P1, N1	No	Multi-Protocol Serial Communication, Power Save Modes
80C152JC	ROMLESS	256	2	1	0	40	12,16.5	CHMOS	P1,N1	N/A	Multi-Protocol Serial Communication, Power Save Modes
83C152JC	8K ROM	256	2	1	0	40	12,16.5	CHMOS	P1,N1	N/A	Multi-Protocol Serial Communication, Power Save Modes
80C152JD	ROMLESS	256	2	1	0	56	12,16.5	CHMOS	N1	N/A	Multi-Protocol Serial Communication, Power Save Modes
80C51SLAH	ROMLESS	256	2	1	4	24	16	CHMOS	Ku	N/A	Keyboard Controller, Power Save Modes
81C51SLAH	16K *ROM	256	2	1	4	24	16	CHMOS	Ku	No	Keyboard Controller, Power Save Modes
83C51SLAH	16K ROM	256	2	1	4	24	16	CHMOS	Ku	No	Keyboard Controller, Power Save Modes
87C51SLAH	16K OTP	256	2	1	4	24	16	CHMOS	Ku	No	Keyboard Controller, Power Save Modes
80C51SLAL	ROMLESS	256	2	1	4	24	16	CHMOS	Sb	N/A	Low voltage, 4 Channel 8-bit A/D, Power Save Modes
81C51SLAL	16K *ROM	256	2	1	4	24	16	CHMOS	Sb	No	Low voltage, 4 Channel 8-bit A/D, Power Save Modes
83C51SLAL	16K ROM	256	2	1	4	24	16	CHMOS	Sb	No	Low voltage, 4 Channel 8-bit A/D, Power Save Modes
87C51SLAL	16K OTP	256	2	1	4	24	16	CHMOS	Sb	No	Low voltage, 4 Channel 8-bit A/D, Power Save Modes



ROM/EPROM (bytes):  
 \*ROM=SystemSoft Standard BIOS  
 Speed (Mhz): 33=33 Mhz operation  
 24=24 Mhz operation  
 20\*=20Mhz Available for  
 Commercial Temperature Range Only  
 Security:  
 L1=1 Lock Bits  
 L2=2 Lock Bits  
 L3=3 Lock Bits

Packages:  
 D= 40LD CerDIP  
 Ku= 100LD QFP (Quad Flat Pack)  
 N= 44L PLCC  
 N1= 68LD PLCC  
 P= 40LD PDIPSecurity:  
 P1= 48LD PDIP  
 S= 44LD QFP (Quad Flat Pack)  
 Sb= 100LD SQFP

MCS<sup>®</sup> 96 Architecture

## Intel MCS<sup>®</sup> 96 Microcontroller Family

### Features

- ▲ 16-bit CPU (operating up to 50 MHz)
- ▲ Register-to-register architecture
- ▲ On-chip memory, both ROM and RAM
- ▲ On-chip peripherals
  - Timers/Counters, A/D, HSI/O, EPA, interrupt controller, serial ports, waveform generator, chip select unit on board
- ▲ CMOS design and power down modes
- ▲ Multiplexed/Demultiplexed bus
- ▲ Automotive temperature testing available for PLCC and PDIP packages

### Benefits

- ▲ High performance
- ▲ No accumulator bottlenecks
- ▲ Simpler more efficient code
- ▲ High integration enables low-cost and low chip count designs
- ▲ Efficient power consumption
- ▲ Interfaces to low cost memories

### Target Applications

- ▲ Printers
- ▲ Hard Disk Drives (<1G byte)
- ▲ Tape Drives
- ▲ Modems/Fax Boards
- ▲ Anti-Lock Brakes
- ▲ UPS (uninterruptible power supply)
- ▲ Copiers
- ▲ Motor control, AC/DC
- ▲ Air Conditioners
- ▲ Engine Control
- ▲ Flow Meters
- ▲ Industrial Robotics

### Product Family

8X9XBH*	8XC196JQ*
8X97JF	8XC196JT*
8XC194	8XC196JS*
8XC198	8XC196JV*
8XC196KB*	8XC196MC
8XC196KC*	8XC196MD
8XC196KD*	8XC196MH
8XC196KR*	8XC196NT
8XC196KS*	8XC196NP
8XC196KT*	8XC196NU
8XC196KQ*	8XC196CA*
8XC196JR*	8XC196CB*

\* Indicates automotive temperature available

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MCS<sup>®</sup> 96 Microcontroller Family Components

DEVICE	ROM/ OTPROM	Register RAM	Code RAM	Timer/ Counters	Analog Input Channels	I/O Pins	I/O Type	Serial Ports	Speed (MHz)	Process	Package	ONCE Test Mode	Address Space	Key Features
8X9XBH	8K	232	NO	2	8	48	HSIO	1	12	HMOS	N-68, R, U, P, C	NO	64K	Low cost, 8/16-bit bus, register-to-register architecture
8X96	8K	232	NO	2	4	48	HSIO	1	12	HMOS	C, P	NO	64K	Lowest cost, 8-bit bus, 4 Channel A/D version of BH
8X9XJF	16K	232	256	2	8	48	HSIO	1	12	HMOS	N-68, U	NO	64K	16K OTPROM, Internal (Code) RAM version of BH
8XC196KB/ 8XC196KB16	8K	232	NO	2	8	48	HSIO	1	12, 16	CMOS	N-68, S-80	YES	64K	Low-Power, High Performance CMOS
8XC19616	8K	232	NO	2	4	48	HSIO	1	16	CMOS	N-52, S-80	YES	64K	Lower-Cost, 8-bit Bus, 4 Channel Version of KB
8XC196KC20	16K	488	NO	2	8	48	HSIO	1	16, 20	CMOS	N-68, S SB-80	YES	64K	16K OTPROM, 488 Byte RAM 3-PWM, PTS
8XC196KD/ 8XC196KD20	32K	1000	NO	2	8	48	HSIO	1	16, 20	CMOS	N-68, S SB-80	YES	64K	32K OTPROM, 1000-byte RAM Version of KC
8XC196MC	16K	488	NO	2	13	53	4 EPA	PTS Mode	16	CMOS	N-84, S, U	YES	64K	PTS, PWM, 3-Phase Waveform Generator
8XC196MD	16K	488	NO	2	14	64	6 EPA	PTS Mode	16	CMOS	N-84, S, U	YES	64K	MC Enhancement with Frequency Generator
8XC196MH	32K	744	NO	2	8	50	6 EPA	2	16	CMOS	N-84, S, U	YES	64K	Enhancement 3-Phase Waveform Generator w/32K EPROM
8XC196KQ	12K	360	128	2	8	56	10 EPA	2	16	CMOS	N-68	YES	64K	10 EPA, 8 A/D, 56 I/O lines, 12K OTPROM
8XC196KR	16K	488	256	2	8	56	10 EPA	2	16	CMOS	N-68	YES	64K	Memory scaler version of KQ
8XC196KS	24K	1000	256	2	8	56	10 EPA	2	16	CMOS	N-68	YES	64K	Memory scaler version of KR with enhanced bus controller
8XC196KT	32K	1000	512	2	8	56	10 EPA	2	16	CMOS	N-68	YES	64K	Memory scalar version of KR with enhanced bus controller
8XC196JQ	12K	360	128	2	6	41	6 EPA	2	16	CMOS	N-52	YES	64K	6 EPA, 6 A/D, 52L package for cost sensitive applications
8XC196JR	16K	488	256	2	6	41	10 EPA	2	16	CMOS	N-52	YES	64K	6 EPA, 6 A/D, 52L package, more memory than JQ
8XC196JS	24K	1000	256	2	6	41	6 EPA	2	16	CMOS	N-52	YES	64K	6 EPA, 6 A/D, 52L package, more memory than JR
8XC196JT	32K	1000	512	2	6	41	6 EPA	2	16	CMOS	N-52	YES	64K	6 EPA, 6 A/D, 52L package, more memory than JS
8XC196JV	48K	1.5K	512	2	6	41	6 EPA	2	20	CMOS	N-52	YES	64K	1.5K RAM, 52L pkg for cost sensitive applications
8XC196CA	32K	1000	256	2	6	44	6 EPA	2	20	CMOS	N-68	YES	64K	Integrated CAN 2.0 Controller
8XC196CB	56K	1.5K	512	2	8	56	10 EPA	2	20	CMOS	N-84	YES	1M	Integrated CAN 2.0, 1MB linear address range, 2K total RAM
8XC196NP	4K	1000	NO	2	0	32	4 EPA	1	25	CMOS	S-100 SB-100	YES	1M	1M byte Linear Address Range Low Power, 6-Chip Selects, 3 PWMs, Demux Bus
8XC196NT	32K	1000	512	2	4	56	10 EPA	2	20	CMOS	N-68	YES	1M	1M Byte Linear Address Range
80C196NU	NO	1000	NO	2	0	32	4 EPA	1	40, 50	CMOS	S-100	YES	1M	1M Byte Linear Address Range, 6 Chip Selects, 3 PWMs, Demux bus

## Contact Information

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## Packages:

C = 48L Ceramic DIP  
N-52 = 52L PLCC  
N-68 = 68L PLCC  
P = 68L Plastic DIP  
R = 68L Ceramic LCC  
S = 80L QFP (EIAJ)  
S-100=100L QFP  
SB-100=100L SQFP  
U = 64L Shrink DIP



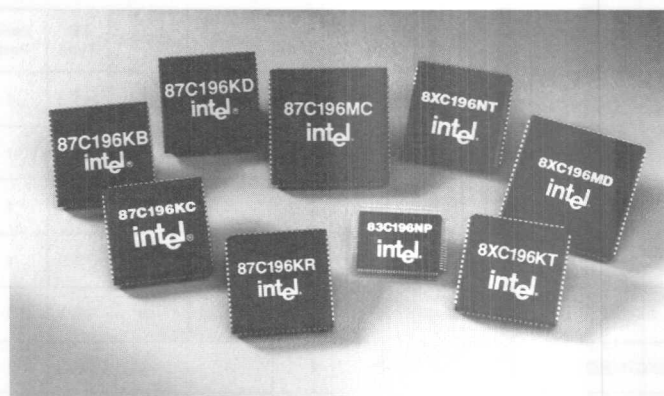


## 80C196NU Microcontroller

## 80C196NU Microcontroller

### Features

- ▲ 40 & 50 Mhz operation
- ▲ 1M byte of linear address space
- ▲ 1000 bytes of register RAM
- ▲ Register to register architecture
- ▲ Chip select units with 6 chip select pins
- ▲ Dynamic demultiplexed/multiplexed address/data bus per chip select
- ▲ 32-bit accumulator
- ▲ Clock doubler or quadrupler
- ▲ Programmable 0, 1, 2, 3 wait states per chip select
- ▲ Programmable 8/16-bit bus width per chip select
- ▲ Programmable address range per chip select
- ▲ 33 I/O port pins
- ▲ 31 Prioritized interrupt sources
- ▲ 4 External interrupt pins
- ▲ 4 High speed capture/compare event processor array channels
- ▲ Two flexible 16-bit timer/counters with quadrature counting capability
- ▲ 3 PWM units/pins
- ▲ Full duplex serial port with dedicated baud rate generator
- ▲ Peripheral transaction server (Pseudo DMA)
- ▲ 960 ns 32/16 unsigned divide
- ▲ 100L SQFP, 100L QFP packages

### Product Overview

The 80C196NU is a footprint compatible upgrade to the 80C196NP. It operates at 50 MHz and doubles the performance of the 80C196NP. The 80C196NU also has a demultiplexed address/data bus to make it easier to design low cost memory solutions.

The address/data bus can be dynamically switched between demultiplexed and multiplexed mode. The 80C196NU can address 1M byte of linear address space and has a dynamic 8- 16-bit data bus width.

A chip select unit is integrated onboard the 80C196NU which eliminates glue logic such as address decoders and wait state generators. Six separate chip selects are provided with a 256 byte resolution. Each chip select control register can configure an address range for 8-/16-bit data bus, 0-3 wait states, and either a multiplexed or demultiplexed address/data bus.

For event capture and output compare the 80C196NU uses the flexible Event Processor Array (EPA) with 80 ns of resolution.

The 80C196NU offers a Peripheral Transaction Server (PTS), which is an alternative way to service an interrupt. The PTS reduces latency and overhead, similar to a DMA. The PTS is capable of handling single and block transfers as well as High Speed Input/Output servicing without executing an interrupt service routine.

Three pulse width modulator units are also on the 8XC196NU. Each unit has eight bit resolution. The maximum frequency of each PWM channel at a 50 MHz clock frequency is 97.6 KHz. With the prescaler set the maximum frequency is 24.4 KHz.

The 80C196NU is the hybrid of the 8XC196KD and the 8XC196NT, combining the best of both controllers with optimal integration. The 80C196NU is also available in CPU version only.

The 80C196NU has 33 I/O pins, a serial port, and two 16-bit timers which can be cascaded to make a 32-bit timer. Two sixteen bit timers can be clocked externally or internally up to 12.5 MHz. For motion control applications, two quadrature clocking inputs are available for both timers. Direction control pins are available for each timer.

(continued)

## 80C196NU Microcontroller

(continued)

## 80C196NU Microcontroller Fact Sheet

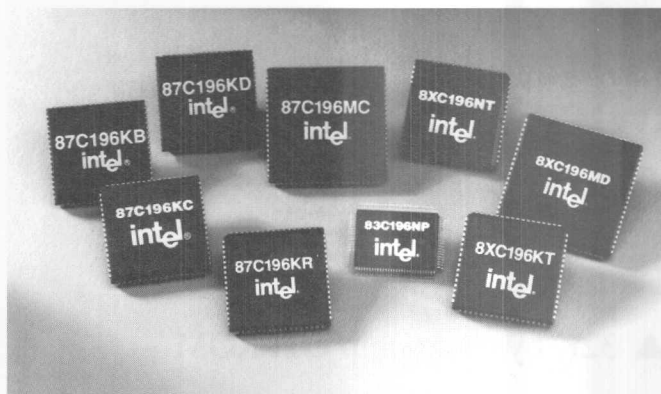
### Benefits

- ▲ High performance
- ▲ More space for high level language compilation
- ▲ Fast data manipulation with register space
- ▲ Fast context switching
- ▲ Glueless memory interfacing
- ▲ Fast external memory accesses on commodity memory devices
- ▲ 560 ns multiply and accumulate
- ▲ Reduces external noise
- ▲ Eliminates need to design wait state generator
- ▲ Flexible 8-, 16-bit memory selection
- ▲ Eliminates PAL for address decoding
- ▲ Very flexible I/O ports
- ▲ Variety of interrupt sources
- ▲ More simple logic one detects
- ▲ Precision event capture, output compare

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**intel**®



- ▲ Versatile timer/counter/quadrature input structure
- ▲ No CPU overhead PWM
- ▲ Flexible baud rate generator
- ▲ Reduced interrupt overhead
- ▲ Powerful 32-bit divide
- ▲ Reduce board space, small form factors

### Software Support Tools

#### BSO Tasking

- ▲ 24-bit C-compiler available today
- ▲ 24-bit C-assembler available today

#### Hardware Support Tools

- ▲ ICE by Nohau Corporation
- ▲ ICE by Dr. Krohn and Stiller (also available through BSO/Tasking)
- ▲ Demo board by Intel available through distribution

## 87C196CA Microcontroller

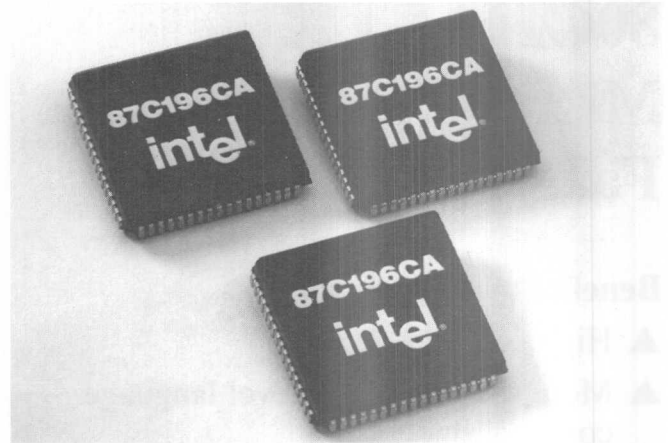
### 87C196CA Microcontroller with CAN 2.0

#### Features

- ▲ 32K bytes on-chip OTPROM
- ▲ 1K bytes register file RAM & 256 bytes additional RAM (Code RAM)
- ▲ 6 high-speed capture/compare EPAs
- ▲ 6 high-speed compare timers (no pins)
- ▲ 2 flexible 16-bit timer/counters
- ▲ 6 analog-digital channels (10-bit)
- ▲ Full duplex serial I/O port (UART)
- ▲ Full duplex synchronous serial I/O port
- ▲ 1.75 $\mu$ s 16-bit multiply & 3 $\mu$ s 32/16 divide
- ▲ Up to 44 I/O port pins
- ▲ 68 Lead Plastic Leaded Chip Carrier (PLCC)

#### Contact Information

Intel Corporation  
2200 Mission College Blvd.  
Santa Clara, CA 95052-8119  
Tel: (800) 628-8686  
FaxBack: (800) 628-2283



#### Benefits

- ▲ No accumulator bottlenecks
- ▲ Fast context switching
- ▲ On-chip CAN reduces board noise
- ▲ Less CPU burden to service CAN node
- ▲ Updatable run time code using Code RAM
- ▲ Fast, precise event control
- ▲ High resolution timing of multiple events
- ▲ Communication with standard chips

The Intel logo, consisting of the word "intel" in a lowercase, sans-serif font, with a registered trademark symbol (®) to its upper right.

(continued)



## 87C196CA Microcontroller

(continued)

# 87C196CA Microcontroller with CAN 2.0

## Product Overview

The 87C196CA is Intel's first high-performance microcontroller with integrated CAN 2.0. Intel has combined the most widely used 16-bit microcontroller architecture and the automotive industry's standard high-speed networking protocol, all on one chip. Integrating CAN on the CPU decreases printed circuit board area, allows faster access to CAN messages and decreases board noise.

The 87C196CA is a member of the MCS<sup>®</sup> 96 16-bit microcontroller family which targets real-time event control. The 87C196CA provides an upgrade path for members of the 87C196Kx/87C196Jx families.

## Product Highlights

- Automotive grade 16-bit microcontroller (40°C to +125°C ambient)
- Register to register architecture
- Supports CAN Specification 2.0, both 11- and 29-bit message identifiers with two programmable acceptance masks
- The 87C196CA on-chip CAN is software compatible with the Intel 82527 stand-alone CAN chip
- 15 message objects of 8-byte data length including one buffered receive message

## Development Tools

The Dearborn Group offers an evaluation board for the 87C196CA which also features a second CAN node using the Intel 82527 CAN chip. This evaluation board contains a software monitor that assembles MCS<sup>®</sup> 96 microcontroller code on-line.

The Dearborn Group  
37632 Hills Tech Drive  
Farmington Hills, MI 48331  
Phone (810) 488-2080  
FAX (810) 488-2082

## Summary

In 1989, Intel began full production of the 82526, the industry's first CAN serial communications controller. Intel provided the first available implementation of CAN 2.0 with production units of the 82527 in 1993. Today, Intel combines 16-bit microcontroller performance with the CAN 2.0 standard protocol on one chip, the 87C196CA.



## 87C196CA CAN Address Map

1E00H	Control Register
1E01H	Status Register
1E02-1E05H	Reserved
1E06-1E07H	Global Mask - Standard
1E08-1E0BH	Global Mask - Extended
1E0C-1E0FH	Message 15 Mask
1E10-1E1EH	Message 1
1E20-1E2EH	Message 2
1E30-1E3EH	Message 3
1E3FH	Bit Timing Reg. #0
1E40-1E4EH	Message 4
1E4FH	Bit Timing Reg. #1
1E50-1E5EH	Message 5
1E5FH	Interrupt Register
1E60-1E6EH	Message 6
1E70-1E7EH	Message 7
1E80-1E8EH	Message 8
1E90-1E9EH	Message 9
1EA0-1EAEH	Message 10
1EB0-1EBEH	Message 11
1EC0-1ECEH	Message 12
1ED0-1EDEH	Message 13
1EE0-1EEEH	Message 14
1EF0-1EFEH	Message 15

## Contact Information

Intel Corporation  
2200 Mission College Blvd.  
Santa Clara, CA 95052-8119  
Tel: (800) 628-8686  
FaxBack: (800) 628-2283

## 80186/80C186

# 80186/80C186

## Embedded Processor Family

### Features

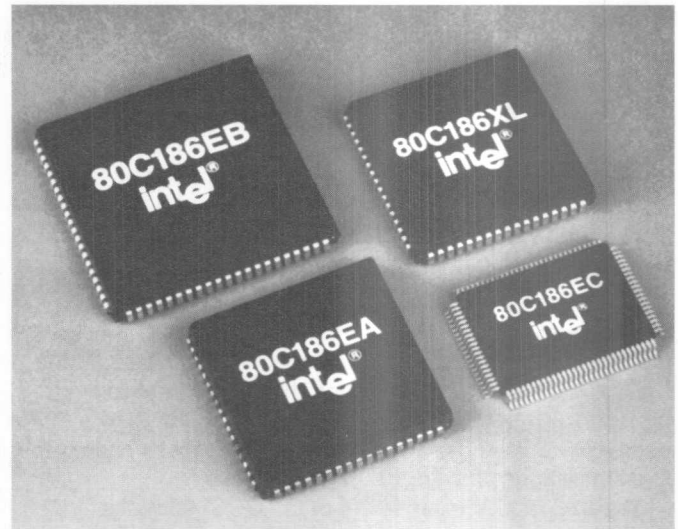
- ▲ 16-bit CPU (Operating up to 25 MHz)
- ▲ 8086 instruction set
- ▲ 1M byte addressing
- ▲ On-chip peripherals: Timers/Counters, DMA interrupt controller, serial ports, etc.
- ▲ Power management unit
- ▲ 3 volt versions (operating up to 16 MHz)

### Benefits

- ▲ High performance
- ▲ Use PC for easy development/debug
- ▲ Large address space
- ▲ High integration enables low cost and low chip count designs
- ▲ Efficient power consumption
- ▲ Enables portable, battery designs

### Contact Information

Intel Corporation  
2200 Mission College Blvd.  
Santa Clara, CA 95052-8119  
Tel: (800) 628-8686  
FaxBack: (800) 628-2283



### Target Applications

- Hard Disk Drives (<1G byte)
- Modems/Fax Boards - Multiplexers
- Portable, Hand-held Terminals
- PBXs

### Product Family

80C186XL	80C186EA
80C188XL	80C188EA
80L186EA	80L188EA
80C186EC	80C186EB
80C188EC	80C188EB

(continued)

## Intel 80C186/80C186 Embedded Processors

(continued)

PRODUCT	SPEED (MHZ)	I/O PINS	SERIAL PORTS	TIMERS/ CTRS	STATIC DESIGN	SYS.MGT. MODE	A20 GATE	ADD. SPACE	DMA CHAN.	WDT
<b>Intel 186 Standard Product Family</b>										
80186/80188	8, 10	0	NO	3	NO	NO	NO	1M	2	NO
80C186XL/188XL	12, 20, 25	0	NO	3	YES	NO	NO	1M	2	NO
80C186XL/188XL	25	0	NO	3	YES	NO	NO	1M	2	NO
<b>Intel 186 Enhanced Product Family</b>										
80C186EA/188EA	13, 20	0	NO	3	YES	NO	NO	1M	2	NO
80C186EA/188EA	25	0	NO	3	YES	NO	NO	1M	2	NO
80L186EA/188EA	8, 13	0	NO	3	YES	NO	NO	1M	2	NO
80C186EB/188EB	13, 20, 25	16	2	3	YES	NO	NO	1M	0	NO
80C186EB/188EB	25	16	2	3	YES	NO	NO	1M	0	NO
80L186EB/188EB	16	16	2	3	YES	NO	NO	1M	0	NO
80L186EB/188EB	8, 13, 16	16	2	3	YES	NO	NO	1M	0	NO
80C186EC/188EC	13, 20, 25	22	2	3	YES	NO	NO	1M	4	YES
80C186EC/188EC	25	2	2	3	YES	NO	NO	1M	4	YES
80L186EC/188EC	13	22	2	3	YES	NO	NO	1M	4	YES

PRODUCT	CLK GEN.	PWR. OPTIONS	CHIP SELECT	INTERRUPT CTLR.	DRAM REFRESH	INPUT LVLS	VOLTAGE	PACKAGE	TEMP
<b>Intel 186 Standard Product Family (continued)</b>									
80186/80188	YES	NO	13	YES	NO	TTL	5.0V	A68,N68,R	C, E, M
80C186XL/188XL	YES	PS	13	YES	YES	TTL	5.0V	A68,N68,R,S80,SB80	C, E, M
80C186XL/188XL	YES	PS	13	YES	YES	TTL	5.0V	A68,N68,R,S80,SB80	C, E, M
<b>Intel 186 Enhanced Product Family (continued)</b>									
80C186EA/188EA	YES	PS, PD, I	13	YES	YES	CMOS	5.0V	N68,S80,SB80	E
80C186EA/188EA	YES	PS, PD, I	13	YES	YES	CMOS	5.0V	N68,S80,SB80	C
80L186EA/188EA	YES	PS, PD, I	13	YES	YES	CMOS	5.0V	N68,S80,SB80	E
80C186EB/188EB	YES	PD, I	0	YES	YES	CMOS	5.0V	N84,S80,SB80	E, M
80C186EB/188EB	YES	PD, I	10	YES	YES	CMOS	5.0V	N84,S80,SB80	C
80L186EB/188EB	YES	PD, I	10	YES	YES	CMOS	5.0V	N84,S80,SB80	C
80L186EB/188EB	YES	PD, I	10	YES	YES	CMOS	5.0V	N84,S80,SB80	E
80C186EC/188EC	YES	PS, PD, I	10	YES (8259A)	YES	CMOS	5.0V	KU100,S100,SB100	E
80C186EC/188EC	YES	PS, PD, I	10	YES (8259A)	YES	CMOS	5.0V	KU100,S100,SB100	C
80L186EC/188EC	YES	PS, PD, I	10	YES (8259A)	YES	CMOS	5.0V	KU100,S100,SB100	E

**POWER OPTIONS:**

PD = Power Down

PS = Power Save

I = Idle

TEMPERATURE RANGES: (Degrees Centigrade)

C = Commercial ( 0-70 )

E = Extended (-40 - 85 )

M = Military ( -55 - 125 )

\* Intel's Military and Special Products offer industrial-strength semiconductors optimized for wide temperature ranges.

Intel Architecture 80C186/80C186 Embedded Processors

**PACKAGING:**

A = 132ld, 68ld (186) Ceramic Pin Grid Array (PGA)

FA = 144ld Plastic Quad Flatpack (PQFP)

KD = 100ld Plastic Quad Flatpack (PQFP)

KU = 132ld, 100ld (186) Plastic Quad Flatpack (PQFP)

NG = 100ld (SX), 132ld (DX) Plastic Quad Flatpack (PQFP)

R = 68ld Ceramic Leadless Chip Carrier (LCC)

N = 68ld, 84ld (EB) Plastic Leaded Chip Carrier (PLCC)

S = 80ld, 100ld (EC) Quad Flatpack (QFP-EIAJ)

SB = 80ld, 100ld (EC) Shrink Quad Flatpack (SQFP-EIAJ)

X = SmartDie™ Products

\* For further information, please call 1-800-548-4725 and ask to receive the SmartDie™ Product Literature Kit No. G1B03. Intel SmartDie™ Products are functionally equivalent die-level silicon versions of standard Intel products. All SmartDie™ Products are tested to meet commercial specifications to ensure the same quality and reliability levels of packaged products. SmartDie™ Products offer the user a cost effective packaging alternative for those demanding small form factor applications.



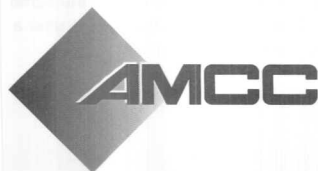
## S44XX and SC3XXX

## S44XX Multi-frequency Clock Generators and SC3XXX Low Skew Clock Drivers

- ▲ Generate and distribute multiple TTL clock outputs from 20 MHz to 80 MHz or PECL clock outputs to 160 MHz
- ▲ Support clock doubling, dividing, invert and lead/lag functions
- ▲ S44XX Clock Generators provide internal Phase Locked Loop (PLL) with VCO operating at 160 to 320 MHz
- ▲ All outputs leading edge synchronized to  $\leq 500$  ps at frequencies up to 80 MHz
- ▲ SC3XXX Clock Drivers have "patented" outputs with source series termination eliminating overshoot and undershoot—no additional on-board termination is required

### Contact Information

AMCC  
6195 Lusk Boulevard  
San Diego, CA 92121  
Tel: (800) 755-2622  
Fax: (619) 450-9885



Clock Generator/Synthesizer Selection Guide					
P/N	Description	Input Reference	No.	Type	Max. O/P Freq.
S4402	Multiphase Clock Generator	TTL	6	TTL	80
S4403	Multiphase Clock Generator	TTL	10	TTL	80
S4405	Multiphase Clock Generator w/PECL I/O	PECL/TTL	6 1	TTL PECL	80 160
S4406	Clock Generator with Delay Adj. & Invert	TTL	12	TTL	66
S4501	Clock Multiplier	TTL	2	TTL	100
S4503	Clock Synthesizer	XTAL	2 1	TTL PECL	80 300

Clock Driver Selection Guide				
Output Frequency with Respect to Input Frequency				
P/N	Total Outputs	Number of Outputs $\div 1$	Number of Outputs $\div 2$	Number of Selectable Outputs $\div 2$ or $\div 4$
SC3500	20	10	5 $\div 1$ or 2	5 $\div 2$ or 4
SC3506*	20	10	10	N/A
SC3507	20	10	N/A	10 $\div 2$ or 4
SC3508*	20	20	N/A	N/A
SC3517	10	5	N/A	5 $\div 2$ or 4
SC3518*	10	10	N/A	N/A
SC3526	9	5	4	N/A
SC3527	10	3	7	N/A
SC3528	10	10	N/A	N/A
SC3529	10	10	N/A	N/A
SC3368*	14	6	8	N/A

\*Also available in 3V

### Product Information

System designs based on high performance microprocessors often require multiple frequencies or phases of the reference clock to maintain optimum speed while minimizing the effects of skew, bus timing and EMI.

The S44XX devices provide up to 12 outputs. Within an output bank each output is guaranteed to be skewed  $\leq 250$  ps from any other output. The outputs can be programmed using a series of control pins to produce signals that are 2x or 1/2x the "primary" output frequency. The output phase can also be modified to generate leading or lagging clocks.

AMCC's SC3XXX family of clock drivers are specifically designed to distribute multiple clock signals. The drivers distribute up to 20 copies of a reference clock with low skew while effectively limiting induced ground noise. The drivers support symmetrical rise/fall times of less than 1.5 ns without "ground bounce."

### Processors Supported

All Intel Microprocessors.

### Availability

Production quantities available now.

### Ordering Information

For more information call us toll-free at 1-800-755-2622.



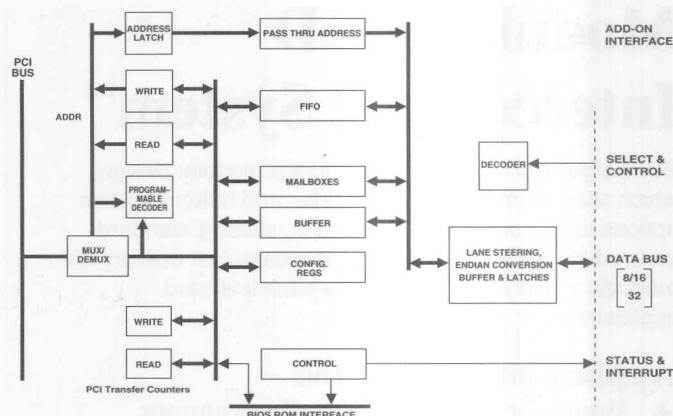
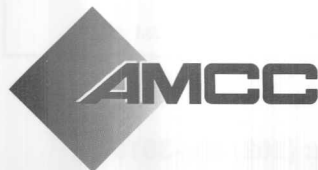
## S593X PCI

# S593X PCI Matchmaker Controllers

- ▲ Single-chip PCI bus master/slave interface for add-on products
- ▲ 8-, 16-, or 32-bit add-on bus width
- ▲ BIOS interface allows customizing
- ▲ Low-cost, fast time-to-market path for add-on card vendors to get onto the PCI Bus
- ▲ Three interface modes—FIFO, mailbox, and pass-thru

## Contact Information

AMCC  
6195 Lusk Boulevard  
San Diego, CA 92121  
Tel: (800) 755-2622  
Fax: (619) 450-9885



## Product Information

AMCC's PCI local bus master/slave controllers provide a high performance single-chip solution between the PCI local Bus Standard and custom add-on boards. Address decoding, address sourcing, burst transfers, and all elements necessary to perform efficient and timely data transfers are provided within the device. Included is a bi-directional 32-bit wide FIFO which facilitates the system-to-system synchronization and data transfers between the local bus and the add-on product. A custom BIOS EPROM can be used to perform any pre-boot initialization required of the add-on function. The external ROM/EPROM/FLASH/NVRAM can be either in eight-bit or serial form and provides a convenient method to customize an add-on board.

This component is designed to permit the direct connection between the PCI local bus and a variety of general purpose microprocessor style buses. Bus master transfers can be performed on the PCI Local Bus while accesses occur on the add-on's processor bus. Transfer parameters, such as the PCI address, transfer counts, mailbox registers, and status are provided in the PCI interface controller as I/O mapped locations on the PCI bus.

The PCI Local Bus Master/Slave Controller consists of three signal groupings: the Local Bus signals, the EPROM interface, and the add-on general purpose bus signals.

## Processors Supported

All Intel Microprocessors.

## Availability

Production quantities available now.

## Ordering Information

For more information call us toll-free at (800) 755-2622.

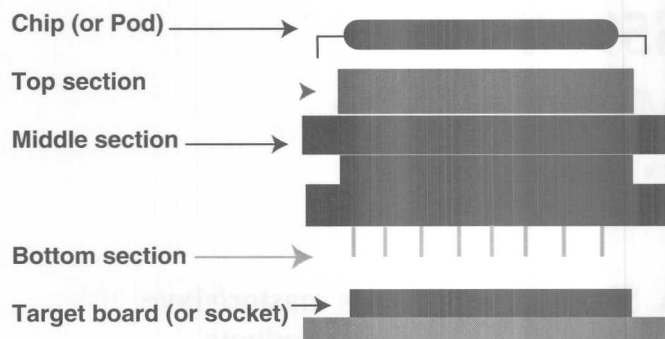
## Modular R&amp;D

# Modular R&D Interconnect System™

EDI Corporation accessories feature a modular design, which allows almost any top, middle, and bottom section options to be combined into one unit, utilizing standard parts which are kept in stock. This means fast delivery on products which are well suited for each intended application.

## Applications Supported

- |                  |               |                    |                       |
|------------------|---------------|--------------------|-----------------------|
| ▲ Emulator       | ▲ Programmer  | ▲ Test and burn-in | ▲ Chip substitution   |
| ▲ Logic analyzer | ▲ Prototyping | ▲ Fault analysis   | ▲ Pinout modification |



## Top Section Options

This section accepts packages, emulator pods, logic analyzer and other instrument probes.	▲ DIP (100 mil pitch) ▲ Shrink DIP (70 mil pitch) ▲ ZIP (zig zag) ▲ PGA	▲ PLCC (plastic or ceramic J-bend) ▲ LCC (leadless ceramic) ▲ SOJ (50 mil pitch) ▲ SOIC (50 mil pitch)	▲ SSOP (30 mil pitch) ▲ TSOP (20 mil pitch) ▲ QFP ▲ SIMM
<i>Optional monitoring posts:</i>	▲ Straight posts (vertical) ▲ One-row arrangement	▲ L-shaped posts (horizontal) ▲ Two-row arrangement	▲ Selectable grounds
<i>Socket type options:</i>	▲ Production style socket (low number of insertions) ▲ Test socket (ZIF, for large number of insertions) ▲ Surface mount pads on top instead of a socket		

## Middle Section Options

▲ No middle section, (direct board-to-board interconnection)	▲ PC board (rigid assembly)	▲ Ribbon cable	▲ Flexible printed circuit board
<i>Switch options:</i>	▲ None	▲ Vertical (on sides)	▲ Horizontal (on top)
<i>Horizontal shift options (with &amp; without grounds):</i>	▲ None	▲ 600 mils	▲ 100 mils
<i>Extended height options (with or without grounds):</i>	▲ None	▲ 1 inch	▲ 3 inches
	▲ 600 mils	▲ 2 inches	▲ 4.5 inches
<i>For SMT adapters only:</i>	▲ 1-piece assembly		
	▲ 2-piece assembly*		
<i>Plug rotation options:</i>	▲ None	▲ 90°	▲ 180°
			▲ 270°

## Bottom Section Options

This section plugs into the target socket or printed circuit board. Footprint options include:	▲ DIP (100 mil pitch) ▲ Shrink DIP (70 mil pitch) ▲ 300 mil rows (prototype)	▲ PGAs ▲ PLCC ▲ LCC (leadless ceramic)	▲ SOJ (50 mil pitch) ▲ SOIC (50 mil pitch) ▲ SOP (30 mil pitch)	▲ TSOP ▲ QFP ▲ Spring-loaded pogo pins
Pin options:	▲ Surface mount	▲ Solder tall pins	▲ Wire wrap pins	▲ Test clip

\*Two-part assemblies feature interchangeable tops and bottoms. Therefore, more than one top may be specified for each bottom, and vice versa. Both the tops and the bottoms may be purchased separately.

EDI Corporation, PO Box 366 Patterson, CA 95363 Tel: (209) 892-3270 Fax: (209) 892-3610

## Adapters

## Emulator Adapters, Test Clips and Accessories

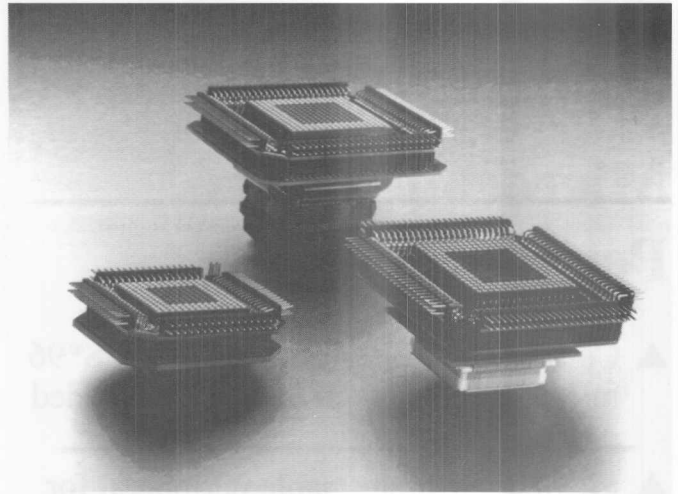
- ▲ Support for 80C186/88EB, 80C186EC, and other derivatives
- ▲ Over 100 different Intel adapters available
- ▲ All versions of PQFP packages supported
- ▲ Unlimited applications consulting
- ▲ Custom adapters available
- ▲ Fully tested and guaranteed for 180 days, parts and labor
- ▲ Free VLSI and SMT Interconnect Solutions Catalog

### Contact Information

Emulation Technology, Inc.  
2344 Walsh Avenue, Bldg. F  
Santa Clara, CA 95051  
Tel: (408) 982-0660  
Fax: (408) 982-0664



EMULATION TECHNOLOGY, INC.



### Product Information

Emulation Technology offers a full line of development adapters and accessories for the Intel family. These development tools provide you with an interface between your Intel device and your logic analyzer, oscilloscope, or emulator, supporting you at every stage of the design process.

### Emulator Tools

Adapt-A-Pod® and Adapt-A-Clip® emulator adapters attach to the socketed or soldered-on Intel MPU and provides your emulator or other test equipment with alternate female footprints.

### Logic Analyzer/Scope Adapters

Bug Catchers extend the leads and label the signals of your IC so it's easy to attach test leads to it. These adapters fit between your Intel MPU and its socket or surface-mount pads, and accept test leads from logic analyzers and oscilloscopes.

### Logic Analyzer Preprocessors

Our passive preprocessors provide a complete interface between the Intel MPU in your target system and your HP logic analyzer, eliminating the time-consuming task of individually connecting each logic analyzer channel to your IC under test.

### PQFP Test Clips

The ET PQFP Clip® allows for hands-free testing of surface-mounted PQFP devices. It provides hardware connection for testing, logic analysis, and emulation.

### Debugging Accessories

We offer a large line of grabbers, handling tools, test probes, insertion/extraction tools, emulator probe rotators, and cost reduction adapters.

### Processors Supported

MCS®96 microcontroller, 80C186/88EB, and 80C186EC.

### Ordering Information

Call ET Headquarters for International Sales offices. Ask about our PC-based 8- and 16-bit emulators, logic analyzers, A/D waveform generators, digital storage oscilloscopes, universal programmers, simulators, and software.

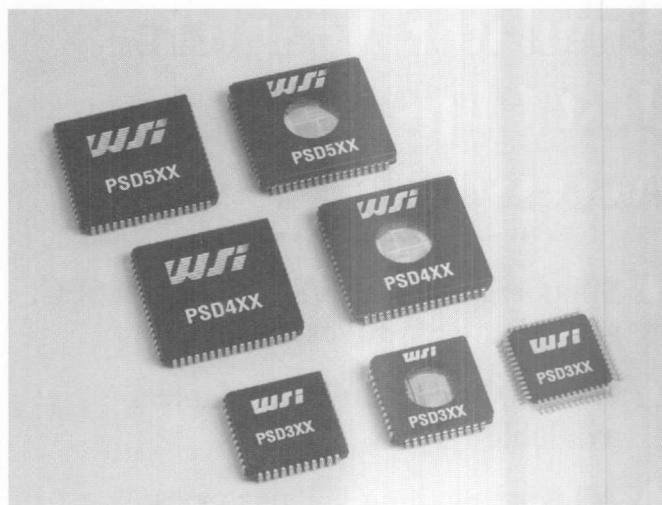
## PSD Family

### PSD3XX/4XX/5XX Programmable Microcontroller Peripherals

- ▲ Compatible with MCS<sup>®</sup> 51 and MCS<sup>®</sup> 96 microcontrollers and 80C186 embedded processor
- ▲ Flexible, programmable peripheral for microcontroller applications
- ▲ Improves performance and simplifies design of real time embedded systems
- ▲ On-board programmable logic
- ▲ Reduce power by over 75% compared to alternate solutions
- ▲ Memory expansion: 256K/512K/1MB EPROM; 16KB SRAM
- ▲ 90 to 200 nsec access time
- ▲ Production pricing starting under \$5.00
- ▲ Alternately sourced

#### Contact Information

WSI, Inc.  
47280 Kato Road  
Fremont, CA 94538  
Tel: (510) 656-5400  
Tel: (800) 832-6974  
Tel: (800) 562-6363 (CA)  
Fax: (510) 657-8495



#### Product Information

Each member of the PSD3XX/4XX/5XX family is a field-programmable CMOS integrated circuit that combines virtually all of the required memory and logic elements for a typical embedded-control design. A PSD device increases system performance while cutting operating power, development time, and cost.

Programmable logic, high performance counters/timers, an 8-level interrupt controller, EPROM, SRAM and port reconstruction are all on-board. The PSD4XX/5XX devices also include 40 programmable I/O pins. In addition, a sophisticated power management system makes the PSD family ideal for space constrained and battery operated systems. A low cost microcontroller and a PSD device form the most cost-effective solution for a very powerful, yet simple, embedded system.

WSI's PC-based PSDSOFT<sup>™</sup> is a menu-driven Microsoft<sup>®</sup> Windows<sup>®</sup> compatible system development tool that is low cost and easy to use. It includes Data I/O's ABEL<sup>®</sup> and Simucad's SILOSIII<sup>®</sup> Verilog-based behavioral simulator along with WSI's fitting and configuration software. The WSI MagicPro programmer provides quick prototyping and rapid system development.



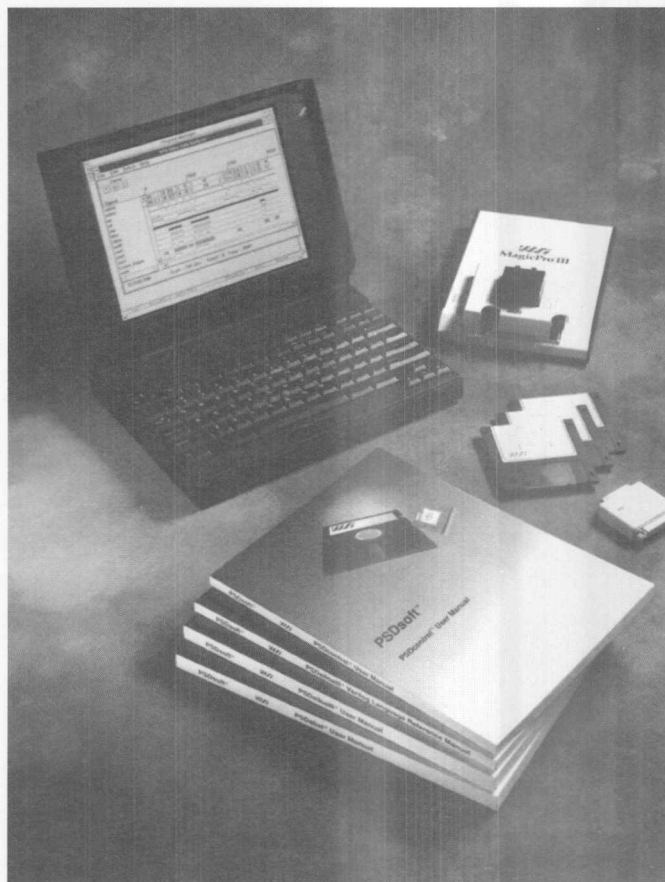


# PSDSOFT™ Development Software for PSD4XX/PSD5XX Microcontroller Peripherals

- ▲ Easy to use - operates under Microsoft® Windows®
- ▲ Includes and integrates the popular Data I/O ABEL® and Simucad SILOSIII® Verilog-based behavioral simulator with WSI's fitting and configuration software - no new design tools to learn
- ▲ Includes logic design, logic optimization, device configuration, fitting, address translation, simulation and programming software

## Contact Information

WSI, Inc.  
47280 Kato Road  
Fremont, CA 94538  
Tel: (510) 656-5400  
Tel: (800) 832-6974  
Tel: (800) 562-6363 (CA)  
Fax: (510) 657-8495



## Product Information

Low cost PSDsoft software development tools provide easy to use design-in support when using PSD4XX or PSD5XX field-programmable microcontroller peripherals. The Microsoft Windows-compatible framework permits the user to quickly select, design, configure and simulate the various PSD device features and memory mapping capabilities required for the system under development.

By including and integrating ABEL and SILOSIII in PSDSOFT, WSI has made it possible to design with PSD devices without learning a new set of design tools. Verilog models of your PSD design can also be used for Verilog simulations at the board or system level.

Included in PSDSOFT is a free 12-month software update service and access to WSI's field applications engineers and factory application group for system design related issues. A 24-hour electronic bulletin board is also provided for design assistance via dial-up modem.

The separately available WSI MagicPro programmer includes an IBM-PC compatible plug-in board and remote socket adapter. It programs all WSI products enabling rapid prototyping and system development.

# PSDSX for Microsoft Windows

PSDSX is the popular  
PC-based behavioral  
modeling and  
simulation software  
for logic  
configuration.

PSDSX is a powerful  
PC-based behavioral  
modeling and  
simulation software  
for logic configuration.  
It is designed to be  
easy to use and  
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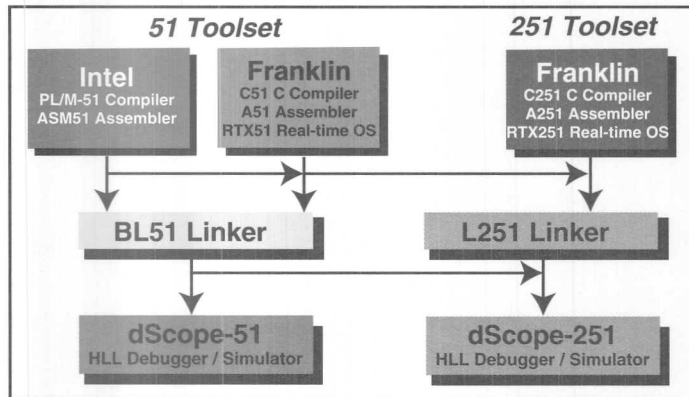
## Section II

# MCS<sup>®</sup> 251 Microcontroller Development Tools

COMPANY	PRODUCT	MCS® 51	MCS® 251	MCS® 96	80C186	PG.
ARCHITECTURES						
Intel MCS® 251 and MCS® 51 Architectures (Article)						33-37
Software Development Tools						
Archimedes	IDE-251 and SimCASE-251	X	X			38
BSO/TASKING	MCS® 251 Microcontroller Dev. Solution		X			39
BSO/TASKING	CrossView 251 Debugger		X			40
BSO/TASKING	MCS® 251 Microcontroller Assembler	X	X			41
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Nohau Corporation	EMUL251™-PC In-Circuit Emulator		X			51

Setting a New Standard for 8051 Product Service & Support!

# Franklin Software



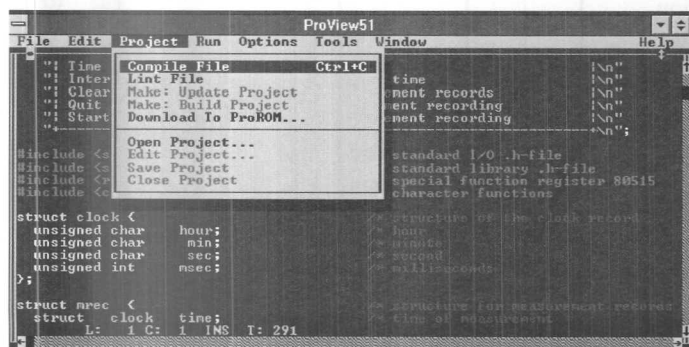
## Franklin's Development Tools

Franklin Software, Inc. supports both the MCS<sup>®</sup> 51 and MCS<sup>®</sup> 251 microcontroller programming with a complementary pair of powerful tool sets:

The C51 Compiler, A51 Macro Assembler, dScope-51 HLL Debugger/Simulator and RTX-51 Real-Time Executive are the industry standard tools for programming of all derivatives and variants of the 8051 microcontroller family.

These tools work well together with Intel PL/M-51 and ASM51. Since the MCS<sup>®</sup> 251 microcontroller is fully code compatible with the 8051 this toolset can also be used to directly generate high quality code for the MCS<sup>®</sup> 251 microcontroller.

The extended MCS<sup>®</sup> 251 microcontroller toolset (C251, A251, dScope-251 and RTX-251) takes full advantage of all MCS<sup>®</sup> 251 microcontroller instructions and addressing modes across the full 16MB 251 address space.



ProView provides a familiar pull-down menu bar. Users of "Turbo C" and Microsoft's "PWB" will feel right at home

**A**ny one who has ever bought software knows that when you buy a C Compiler, even if it's the best in the world, you're buying a lot more than what's in the package.... You're really buying the support and service of the company that stands behind the product.

It's not enough to say our C Compiler is used in over 15,000 installations worldwide, or that it's long been recognized as the 8051 standard.

From our perspective, what is important is that we know the designers and developers in those installations. We have to know them—we talk to them all the time...not just to iron out their problems, but to help them with their project, to offer them upgrades and solutions. In short, to make them appreciate that there's more to a Franklin C Compiler than just a package. Franklin Software will be there for you, providing quality software and service well into the 21<sup>st</sup> century.

Want to know more about Franklin's Products and Services? Ask one of the 15,000 developers who have experienced both, or give us a call at (408) 296-8051.



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Info:(408) 296-8056 (fax back)  
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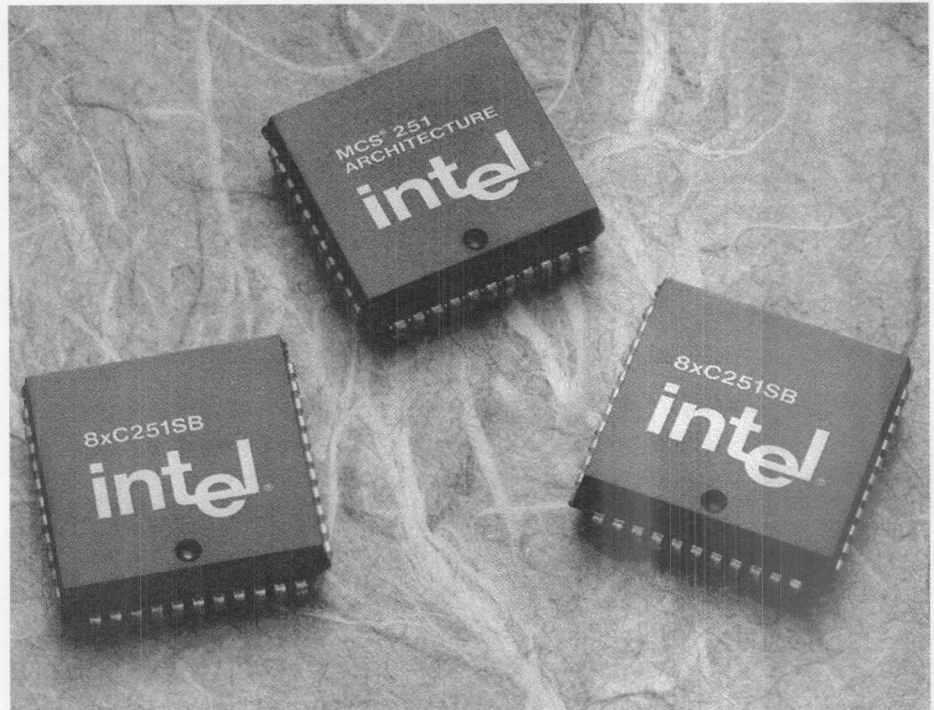
# Intel MCS<sup>®</sup> 251 and MCS<sup>®</sup> 51 Architectures

## The Next Generation: MCS<sup>®</sup> 251 Architecture

Using advanced modular design techniques, Intel launched the next generation of its 8-bit (8051) architecture: the MCS<sup>®</sup> 251 architecture. By modifying code using the MCS<sup>®</sup> 251 architecture instructions, performance can be increased up to 15 times! Even with existing MCS<sup>®</sup> 51 microcontroller code, system performance can be boosted up to five times!

The MCS<sup>®</sup> 251 architecture delivers higher performance and a host of other enhanced features including an increased memory mix and addressing, low power, low noise, efficient high-level language support, enhanced instruction set and integrated features and functions. All products in the family are based on the new MCS<sup>®</sup> 251 core architecture.

Most importantly, the new architecture maintains full binary code and pin compatibility with existing MCS<sup>®</sup> 51 microcontrollers. That means you can drop in the 8XC251SB microcontroller, as well as future products based on the MCS<sup>®</sup> 251 architecture core, into existing products with little or no development effort and still get increased performance.



## The New Performance Leader: Intel MCS<sup>®</sup> 251 Architecture

### FEATURES

- 3-stage pipeline CPU architecture.
- 1 state (2 clocks) per machine cycle (vs 6 states (12 clocks) per machine cycle for MCS<sup>®</sup> 51 microcontroller).
- 16-bit internal code bus.
- Enhanced 8051 instruction set with:
  - 16-bit and limited 32-bit data transfer, arithmetic and logic instructions.
  - Register-to-register operations.
  - Extended addressing modes.
  - Improved control instructions.
  - Bigger bit addressable space.
- Binary code-compatible with MCS<sup>®</sup> 51 microcontroller.
- Register-based machine with 40 register bytes accessible as 16 8-bit registers, 16 16-bit registers, 10 32-bit registers or a combination of all. All registers are general-purpose with accumulator functionality and data indexing capability. 64KB extended stack space and additional stack instructions.

- 24-bit linear addressing for up to 16MB memory space.
- Supports 64 interrupt sources.

### BENEFITS

**High performance** — Five to 15 times increase in performance compared to MCS<sup>®</sup> 51 microcontroller at the same clock speed.

**High instruction throughput** — Reduces power consumption and RFI at low clock speed.

**Flexibility** — Increased performance and programming flexibility.

**Optimized code** — Reduced code size.

**Cost savings** — Protects your software investment.

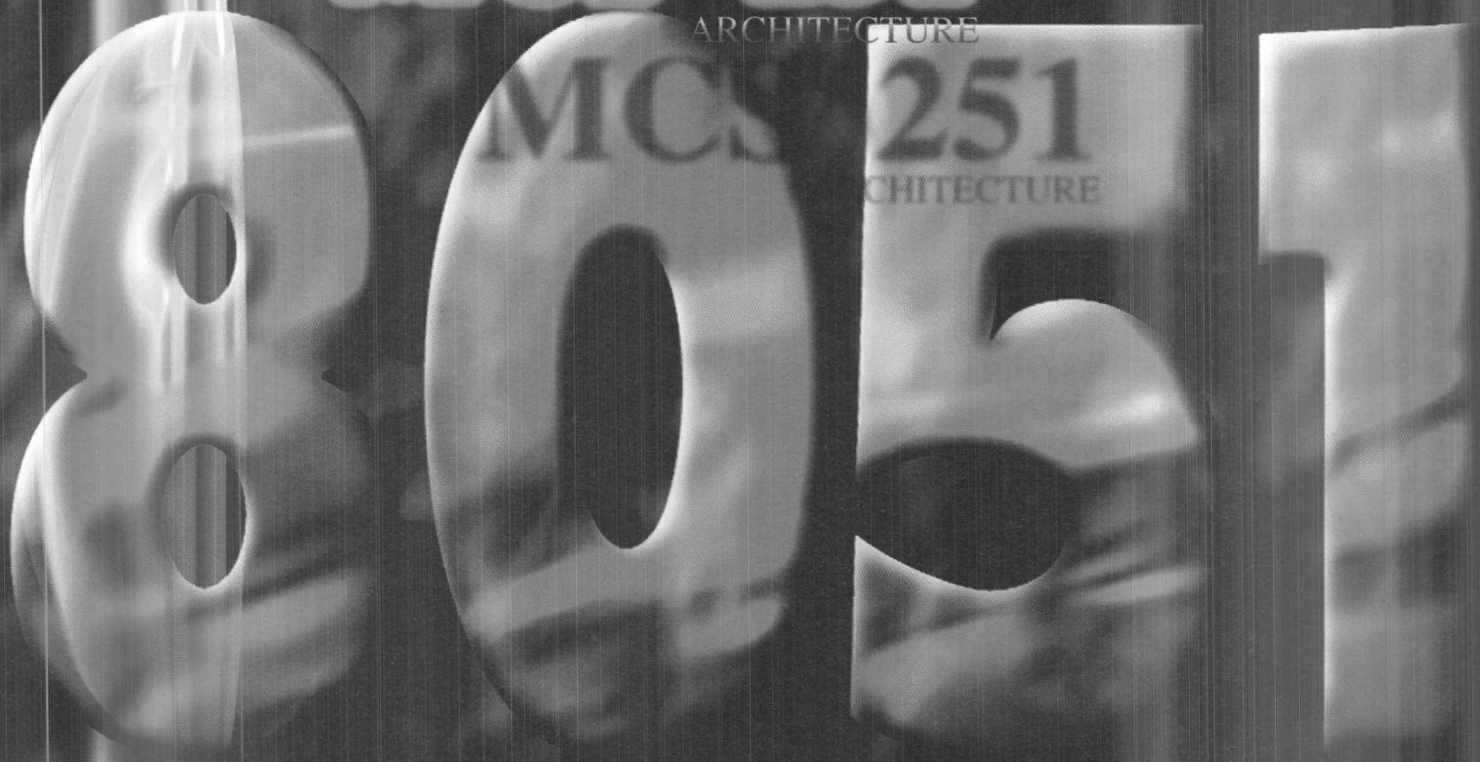
**Easy upgrade** — Simple performance upgrade from MCS<sup>®</sup> 51 microcontroller applications.

**Performance** — Increased programming flexibility.

**Efficiency** — Increased efficiency for C code.

# Raising the Standards

MCS<sup>®</sup> 251  
ARCHITECTURE



**Franklin's new line of development tools let you raise your performance standards to meet your expectations... without raising the stakes!**

**Only Franklin provides a complete line of Intel MCS<sup>®</sup> 51 (8051) and MCS<sup>®</sup> 251 architecture support tools:**

- "C" Language Compilers
- Macro Assemblers
- Debuggers
- Simulators
- Real Time Executives
- Integrated Development Environments
- High End Emulators
- Code Generation Tools
- High End Development Stations

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## 8XC251SB Microcontroller: "Drop-In" Compatibility

The 8XC251SB microcontroller, the first product based on the powerful new MCS<sup>®</sup>251 high-performance architecture core, delivers the performance increases you need for today's applications: up to 15 times faster at the same clock speed! Intel achieved this using advanced controller/processor design techniques such as three-stage pipeline and register-based CPU architecture, and by enhancing and expanding the instruction set.

The true beauty, however, of the 8XC251SB controller is that it's 100 percent binary code and pin compatible with existing Intel MCS<sup>®</sup>51 controller products. It provides you with an easy upgrade path: a direct "drop-in" replacement! Now you can get improved performance with little-to-no additional costs. Because the 8XC251SB controller will boost performance in all existing MCS<sup>®</sup>51 microcontroller applications, it saves you development time and costs, as well as reduces time-to-market.

### FEATURES

- MCS<sup>®</sup>251 architecture core.
- 100% binary code and pin compatible with MCS<sup>®</sup>51 microcontroller.
- 1K on-chip data RAM.
- 16K on-chip OTP, ROM or ROMless versions supported.
- Programmable Counter Array (PCA) supports
  - Real-time capture and compare
  - High speed output
  - PWM.
- Hardware watchdog timer.
- Page mode configuration.
- 0 or 1 wait state configuration for external memory access.
- Support seven interrupt sources, each with four interrupt priority levels.

### BENEFITS

**Performance** — 5 to 15 times performance increase compared to MCS<sup>®</sup>51 microcontrollers at the same clock speed.

- Reduced power consumption and RFI.
- Increased efficiency and support for C language programming.

**Easy upgrade** — Direct 'drop-in' replacement in MCS<sup>®</sup>51 controller applications to achieve performance boost. Software investment protected. Minimal develop-

ment cost and effort required. Quick time-to-market and time-to-money.

**Memory capacity** — Increased internal memory capacity for data manipulation and C language support.

**Flexibility** — Reduced need for additional external memory chips.

**Real-time control applications** — Flexibility and performance enhancement in real-time control applications such as:

- Measurement of duty cycle, phase difference and frequency.
- Real-time interrupt generation and output toggling.
- Adjustable duty cycle generation.

**Reliability** — Increased system reliability.

**Performance** — Increased performance for external instruction fetch by two times.

**Fast or slow memory** — Flexibility in external memory and peripheral interface.

**Event control applications** — Increased flexibility for event control applications.

## MCS<sup>®</sup>251 Development Tools

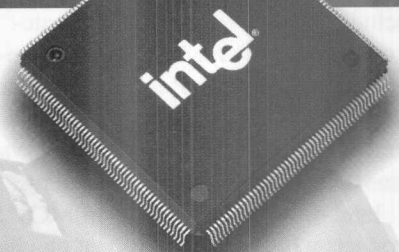
Intel offers you a variety of hardware and software development architectures from some of the industry's leading tools suppliers to support the new MCS<sup>®</sup>251 architecture. These suppliers provide fully-integrated device programming support that features high performance, Windows<sup>™</sup>-based software and full featured, real-time emulators.

ApBUILDER, Intel's interactive programming software, is scheduled to include the MCS<sup>®</sup>251 architecture. ApBUILDER makes the migration to the MCS<sup>®</sup>251 architecture easy: it speeds up the learning curve and reduces your total design time. Fuzzy logic tools give you the leading edge in development efforts with a full line of highly optimized software. The Project Builder 251 Evaluation Kit brings all the hardware and software together in a low cost, turnkey kit.

## MCS<sup>®</sup>51 Architecture: The 8-bit Microcontroller Architecture of Choice

Intel's 8-bit MCS<sup>®</sup>51 family of microcontrollers consists of CHMOS versions of the original 8-bit

# BSO/TASKING MCS251



## Plug Into the Power of MCS<sup>®</sup>251.

Compile your existing  
code for up to  
30X performance improvement

Highly optimized C compiler  
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microcontrollers. The MCS<sup>®</sup> 51 architecture is optimized for control-oriented applications. A variety of fast addressing modes for accessing the internal RAM facilitates byte-processing and numerical operations on small data structures. The instruction set provides a convenient menu of 8-bit arithmetic instructions including multiply and divide instructions. Extensive on-chip support is provided for one-bit variables as a separate data type, allowing direct bit manipulation and testing in control and logic systems that require Boolean processing.

Intel offers a wide variety of MCS<sup>®</sup> 51 products with different levels of on-chip peripherals and memory. The MCS<sup>®</sup> 51 family includes versions with on-chip EPROM, OTP, and ROM memory as well as CPU-only microcontrollers. Intel's proven CHMOS technology provides lower power, higher integration and higher performance in this line of controllers.

#### FEATURES

- 8-bit CPU optimized for event control.
- Boolean Processing.
- On-chip Memory (up to 32K bytes).
- On-chip Peripherals (timer/counters, serial ports, I/O ports, PCA etc.).
- Extensive software and hardware programming support.

#### BENEFITS

- Efficient** — Efficient event control design.
- Ease** — Easy and simple bit manipulation.
- Flexibility** — Enables single chip designs.
- Integration** — High integration enables low-cost and low chip count designs.
- Simple** — Simplifies your design cycle.

## MCS<sup>®</sup> 51 Low Voltage Microcontrollers

The 8XL5X and 8XL51FX are redesigned true 3V versions of the MCS<sup>®</sup> 51 family of microcontrollers. Operating V<sub>cc</sub> ranges from 2.7V to 3.6V and maximum frequency of 20 MHz providing both low voltage and high performance benefits. The microcontrollers provide a compatible and ideal low-voltage migration path if you want to design low power versions of your embedded designs.

#### FEATURES

- Redesigned true 3V operation.

- Optimized for high performance (max freq of 20 MHz).
- Functionally compatible with other MCS<sup>®</sup> 51 microcontrollers.
- Power saving modes (Idle and power down).
- On-chip peripherals (timer/counters, serial ports, I/O ports, PCA etc.).

#### BENEFITS

**Performance** — High performance and low noise.

**No sacrifice** — No performance loss at low voltage.

**Easy migration** — From 5V to 3V designs.

**Power control** — Improved power management control.

**Integration** — High integration enables low-cost and low chip count designs.

## MCS<sup>®</sup> 51 Microcontrollers: Expanded RAM

The 8XC51RA/RB/RC is the random access memory (RAM) expansion of the 80C52/C54/C58 part from 256 byte to 512 byte with the watchdog timer added. Intel designed this microcontroller for 5V operation and functional-compatibility with the Intel 8051 instruction set. It's ideal if your systems and applications require large on-chip data storage.

#### FEATURES

- Expanded internal RAM (512 bytes) size.
- Dedicated hardware watchdog timer.
- Functionally-compatible with other MCS<sup>®</sup> 51 microcontrollers.
- On-chip peripherals (timer/counters, serial ports, I/O ports, etc.).

#### BENEFITS

**Synergy** — More working space on chip. Breaks the 256 byte limitation.

**Control** — Improved system integrity control.

**Compatibility** — Easy migration of existing designs.

**High integration** — Enables low-cost and low chip count designs.

## MCS<sup>®</sup> 51 Microcontrollers: Application Specific

The 8XC152JA/JB/JC/JD, based on the MCS<sup>®</sup> 51 architecture core, is a highly-integrated, single-chip 8-bit microcontroller designed for cost sensitive, high-

speed, multi-protocol serial communications. It is ideal for implementing ISDN, LAN, and user-defined serial backplane applications.

#### FEATURES

- Same instruction set as MCS<sup>®</sup> 51 microcontrollers, software compatible with 80C51.
- Fast data transfer with global serial channel.
- Serial protocol.
- Dual DMA channels.
- SDLC and other HDLC subsets.
- Carrier Sense Multiple Access/Collision Detect.
- Deterministic

#### BENEFITS

**Synergy** — Preserve design team knowledge/investment; no training required.

**Effective** — High effective data rates throughput.

**Cost effective** — Cheaper and can be more reliable than parallel communications; easy to add and subtract nodes.

**Efficient** — Frees CPU for other tasks. On-chip DMA controller simplifies system design and reduces board space.

**Compatible** — Supports proprietary and emerging ISDN applications such as PABX line cards and terminal adapters, and other proprietary networks as in programmable logic controllers.

**Compatible** — Supports IEEE 8023 defined access and other proprietary access methods.

**Unique** — Determine worst-case access time. Allows CSMA/CD to be used in real-time control environments.

Combines some of the best features of traditional methods — deterministic protocol with no polling overhead. Collision resolution scheme.

## 8XC51GB

The 8XC51GB is an enhanced version of the 8XC51FA. Added features make it an even more powerful microcontroller for applications that require on-chip A/D, pulse width modulation, high-speed I/O, up/down counting capabilities and memory protection features. It also has a more versatile serial channel that facilitates multi-processor communications.



## FEATURES

- Same instruction set as MCS® 51 micro-controllers, software compatible with 80C51.
- Enhanced Interrupt structure with:
  - 15 vectors (7 external, 8 internal)
  - 4 programmable priority levels applications.
- 8-channel, 8-bit A/D converter:
  - eight 8-bit result registers
  - four programmable modes
  - automatic comparator reference
  - trigger input pin.
- Two programmable counter arrays.
- Half duplex synchronous serial port.

## BENEFITS

**Synergy** — Preserve design team knowledge/investment; no training required.

**Flexibility** — Flexible and comprehensive interrupt handling capacity for interrupt intensive applications. Reduces CPU overhead to define proper interrupt routing for heavy interrupt driven applications.

**A/D conversions** — Intelligent, accurate A/D conversions allows:

- sequential A/D (one per channel).
- two start and sequencing modes to address any application need.
- more precise A/D conversions.
- minimal CPU overhead, simple interface.

**Precision** — Precise event timing measurement and control capabilities.

**Peripherals** — More I/O peripherals expansion, such as off chip (EEPROM).

## 8XC51SL

The 8XC51SL is an integrated keyboard controller designed for power-sensitive, portable PCs. It offers functions such as an UPI host interface, keyboard scanning, power management, temperature/battery monitoring, and external keyboard/mouse interface. Package option includes PQFP 100ld and SQFP 100ld, with 5V and 3.3V operations.

## FEATURES

- Same instruction set as MCS® 51 micro-controller products, software compatible with 80C51.
- Integration of 80C42-type host interface and keyboard scan.
- Four channels, 8-bit A/D.
- Interface for up to 32KB of external memory.

- Five LED drivers.
- Two serial interfaces.
- Additional power management register set. 3.3V operation.
- 100LD PQFP and SQFP packages.

## BENEFITS

**Synergy** — Preserve design team knowledge and investment; no training required.

**Single chip solution** — Saves board space and lowers system cost, especially in small notebook environment.

**Monitoring** — Battery/CPU temperature and voltage monitoring.

**Flexibility** — Accommodates larger code; flexibility in manufacturing flow.

**Reduces parts** — Eliminates external discrete components.

**Support** — Provides external serial keyboard and mouse support.

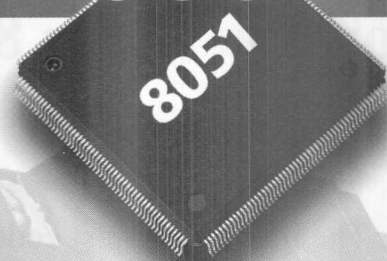
**Efficiency** — Enhanced power management function. Provides greater power savings.

**Saves space** — Small package size for board space savings.

## MCS® 51 Development Tools

The MCS® 51 microcontroller product family is supported by a variety of development tools including *ApBuilder* and evaluation boards. *ApBuilder* is a powerful new design tool for the embedded control application programmer. You'll learn the intricacies of the MCS® 51 microcontrollers quickly, which will shorten your total design time. Complete sets of development utilities and C compilers are available through third-party vendors. Many third-party vendors also provide in-circuit emulator development tools.

# BSO/TASKING 8051



## The Best 8051 Software Tools on the Market.

All 8051 manufacturers  
supported

Highly optimized C and PL/M  
compilers with assembler, linker  
and locator

CrossView® Windows debugger  
with Target ROM or Simulator

Complete ANSI C and runtime  
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Small high performance RTOS

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EDE gives you access to all tools  
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## Archimedes IDE-251

# C-251 & SimCASE-251 for maximum 80251 power

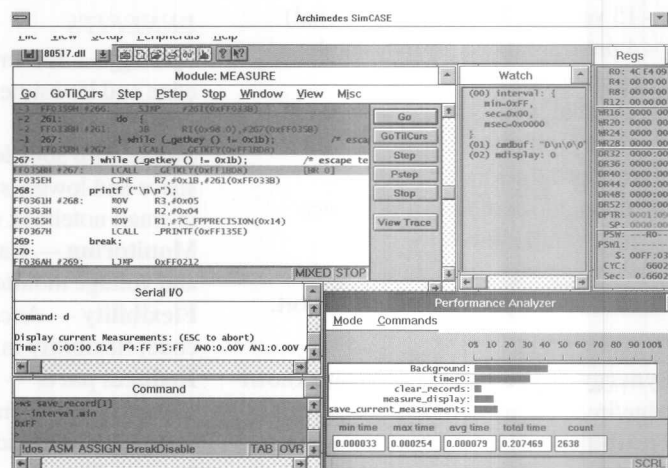
- ▲ The industry's most code efficient C-251 Cross Compiler
- ▲ SimCASE - C/ASM debug & simulation
- ▲ Macro Assembler
- ▲ Optimizing Linker
- ▲ Librarian & ANSI libraries
- ▲ Complete development front-end including editor
- ▲ Windows support
- ▲ All popular emulator & third party tools supported
- ▲ State-of-the-art documentation including tutorials and examples

## Contact Information

Archimedes Software, Inc.  
303 Parkplace Center Ste 125  
Kirkland, WA 98033  
Tel: (206) 822-6300  
Fax: (206) 822-8632  
CompuServe E-Mail: 72662,1601  
Internet E-Mail: 72662.1601@CompuServe.com



ARCHIMEDES  
SOFTWARE



## Product Information

### Top Speed & Size Efficiency

The Intel MCS® 251 microcontroller automatically gives you up to five times faster 8051 code execution, but with code recompiled with the Archimedes C-251 compiler, you can expect up to fifteen times faster code.

### Most Features

Archimedes C-251 compiler is a dedicated ANSI C compiler designed explicitly for the 80251 microcontroller family. Extended features include: ten basic data types including 32-bit and 64-bit IEEE floating point routines, memory selector, four memory models, program size up to 16MB, reentrant code among other powerful features.

### SimCASE-251 - C/ASM Debug & Simulation

Archimedes SimCASE-251 is a superset of Archimedes SimCASE 8051, with full support for the MCS® 251 architecture. Extended features include: full simulation of the 8051 and 80251 CPU with up to 16MB of memory, C Source & ASM debugging with trace, multiple debug windows, execution profiler.

### Archimedes Guarantee

Archimedes was the first company to introduce the PC based ANSI C Cross compiler for the Intel 8051 family back in 1985. Since then, Archimedes Software has dedicated itself by specializing in the microcontroller software market and has developed a unique competence in C compilers & Simulator/Debugger construction for embedded applications. Archimedes offers you the most responsive technical and customer hotlines in the industry.

### Host Systems Supported

PC (WIN 3.1)

### Ordering Information/Product Information

Call (800) 338-1453. Visa and MasterCard are accepted.

### Product Ordering Number

Archimedes IDE-251

C for Intel MCS<sup>®</sup> 251 Microcontroller

## The Intel MCS<sup>®</sup> 251 Microcontroller Development Solution

- ▲ Highly optimizing ANSI C compiler supports the full instruction set and 16MB address space of the 251 architecture
- ▲ Powerful assembler, linker and locator generates ROMable code for total flexibility
- ▲ CrossView<sup>®</sup> Windows simulator debugger for debugging in C, PL/M and assembly
- ▲ 'Starter Pack' delivers instant migration of existing 8051 applications to 251 binary mode with no design changes. Up to 5x the performance
- ▲ 'Power Pack' provides migration from existing 8051 applications to the full 251 instruction set (source mode). Up to 30x the performance
- ▲ Support hotline only a toll free call away

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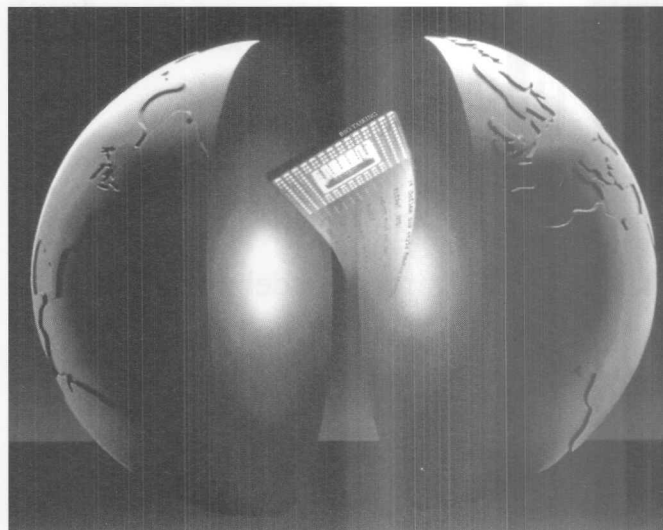
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- ▲ Complete ANSI C libraries in source, and run-time support libraries. Libraries are reentrant
- ▲ In-line assembly and in-line expansion of predefined functions for efficiency
- ▲ Context sensitive help and on-line user manuals
- ▲ Embedded development environment lets users access all tools through a common windows interface

### BSO/TASKING

One supplier, one support hot line, one company ... Established in 1974, BSO/TASKING pioneered the concept of cross development on mini computer systems. Today BSO/TASKING has 100 dedicated individuals who are focused on providing high quality solutions for the embedded systems developer across all computer platforms.

Customer satisfaction is first at BSO/TASKING. We provide a toll free hot line for orders, technical questions, and reporting problems. Our products include a 90 day warranty. Comprehensive technical support can be continued by enrolling in our Maintenance Plan, which entitles you to all future releases including product updates and feature enhancements. Ask our competitors what they charged for their last update!

# CrossView® 251 Debugger

## The Debugging Solution for the MCS® 251 Microcontroller

- ▲ High speed simulator debugger for debugging in C, PL/M and assembly
- ▲ Real Microsoft® and X Windows/Motif interface, lets you navigate around your code with point and click techniques together with key board shortcuts
- ▲ Code in C debug in C. Lets you debug optimized code and supports assembly level debugging
- ▲ Code and software data breakpoints supported
- ▲ Stack tracing
- ▲ I/O simulation using files or windows
- ▲ Context sensitive help and on-line user manuals
- ▲ Support hotline only a toll free call away

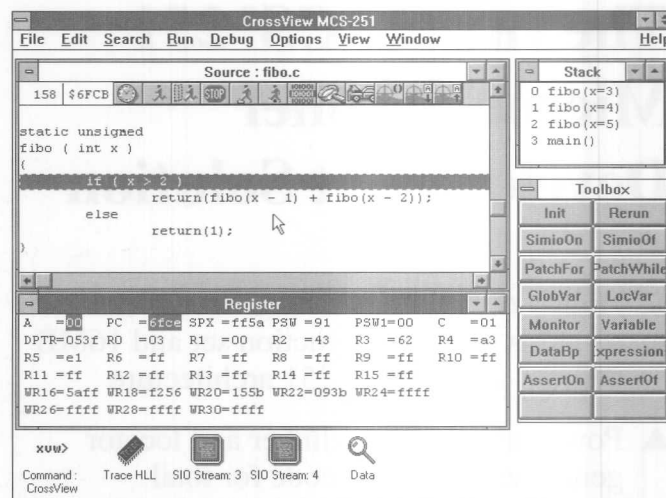
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### Product Information

BSO/TASKING supplies debuggers designed to deliver functionality that will reduce the time spent testing and debugging.

The BSO/TASKING debugger CrossView® not only displays your source code but uses the debug information that the C compiler generates, such as variable and function scoping and typing, including pointers, structures, enumerated types, bitfields and arrays.

There are plenty of views to choose from: source level code, monitor, inspect, on-chip registers, call stack, variables, break point, execution trace, session log, simulated I/O, memory dumps. Multiple overlapping windows can be moved and resized to suit you. Full screen zoom is only a mouse click away.

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# Assembler for Intel MCS<sup>®</sup> 251 Microcontroller

## The 251 Assembler from BSO/TASKING

- ▲ Powerful assembler, linker and locator generates ROMable, relocatable and reentrant code for total flexibility
- ▲ Supports Intel OMF251 and IEEE695 object formats with complete information for symbolic debugging with CrossView<sup>®</sup>
- ▲ 8051 compatible assembler and linker
- ▲ Powerful macro preprocessor
- ▲ Assembler optimizes generic instructions and solves code issues when switching from binary to source mode
- ▲ Special linker steering program to ease migration path from 8051 applications
- ▲ Linker accepts OMF51 object files and libraries

### Contact Information

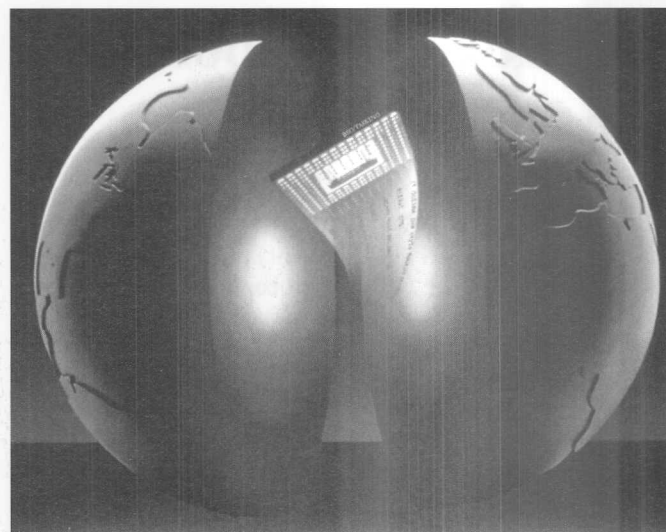
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Nihon TASKING Japan  
BSO/TASKING UK

Tel: +31 33 558584  
Tel: +49 7152 939630  
Tel: +39 2 6698 2207  
Tel: +81 3 3780 0916  
Tel: +44 1252 510014

**BOSTON  
SYSTEMS  
OFFICE  
TASKING**

### Contact Information

BSO/TASKING  
333 Elm Street  
Dedham, MA 02026  
Tel: (617) 320-9400  
Tel: (800) 458-8276  
Fax: (617) 320-9212



- ▲ Support hotline only a toll free call away
- ▲ Segment overlaying fully supported to reduce target memory usage
- ▲ Many utilities included: make, library manager, object conversion utility
- ▲ Context sensitive help and on-line user manuals
- ▲ Embedded development environment lets users access all tools through a common Windows interface

### BSO/Tasking

One supplier, one support hot line, one company... Established in 1974, BSO/TASKING pioneered the concept of cross development on mini computer systems. Today BSO/TASKING has 100 dedicated individuals who are focused on providing high quality solutions for the embedded systems developer across all computer platforms.

Customer satisfaction comes first at BSO/TASKING. We provide a toll-free hot line for orders, asking technical questions, and reporting problems. Our products include a 90 day warranty. Comprehensive technical support can be continued by enrolling in our Maintenance Plan, which entitles you to all future releases including product updates and feature enhancements.

## Development Tools for the MCS<sup>®</sup>251 Microcontroller

There's a powerful new 8051 in town! In September of 1994 Intel announced the MCS<sup>®</sup>251 microcontroller. On that same day we at Franklin Software were proud to announce our complete development tool package for this hot new chip!

- ▲ Completely 8051 executable CODE compatible
- ▲ Fully linear 16MB address space — Execute your previously "banked" 8051 code directly!
- ▲ Runs all of your existing 8051 programs at least 5 times faster!
- ▲ Recompile and run your programs at least 15 or more times faster!
- ▲ True stack oriented instruction set with full 16-bit stack pointer
- ▲ Powerful 8-, 16-, 32-bit instructions
- ▲ Flexible 8-, 16-, 32-bit register implementation
- ▲ Direct CPU support for 16-bit and 32-bit pointers
- ▲ All programs generated with existing Release VII (and up) Franklin Software tools are usable today on your MCS<sup>®</sup>251 microcontroller prototype projects

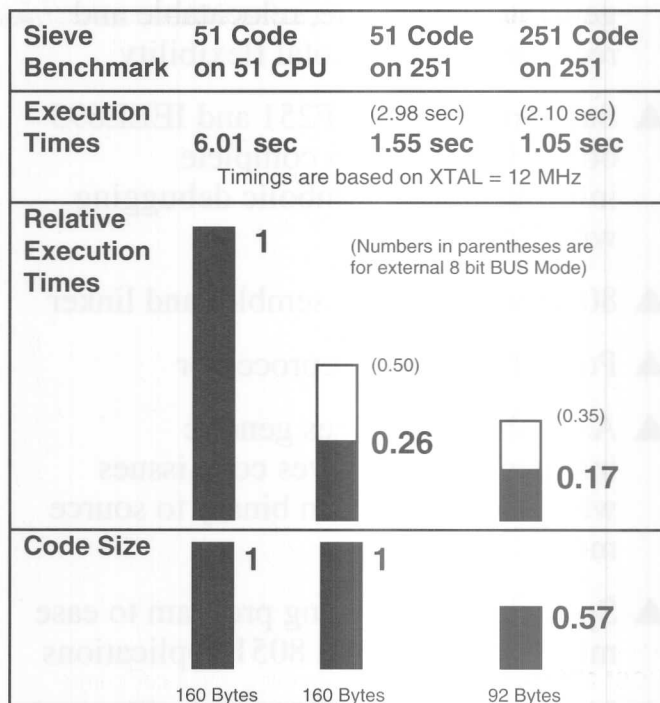
### Contact Information

Franklin Software, Inc.  
888 Saratoga Avenue, Suite #2  
San Jose, CA 95129  
Tel: (408) 296-8051  
Fax: (408) 296-8061  
Info: (408) 296-8056 (fax back)  
BBS: (408) 296-8060

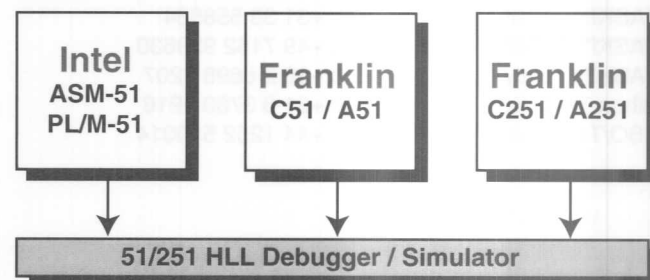


### Product Information

The new Intel MCS<sup>®</sup>251 microcontroller core is a powerful 8-, 16-bit CPU. The MCS<sup>®</sup>251 microcontroller instruction set is a true superset of the MCS<sup>®</sup>51 microcontroller. In its 8051 binary mode, the MCS<sup>®</sup>251 CPU is 100% code compatible to the 8051. The MCS<sup>®</sup>251 architecture permits sure and easy migration of your MCS<sup>®</sup>51 code to true 16-bit power, with a minimum learning curve. Existing hardware can immediately use MCS<sup>®</sup>251 microcontroller power, since the MCS<sup>®</sup>251 microcontroller is a 100% PIN for PIN replacement 80C51FX.



All software developed with your current Franklin 8051 Development Tools and Intel PL/M-51 and ASM-51 can be used directly by the new MCS<sup>®</sup>251 microcontroller family. The Franklin C251 optimizing ANSI C compiler, and the A251 macro assembler take full advantage of the extended MCS<sup>®</sup>251 microcontroller CPU instruction set.

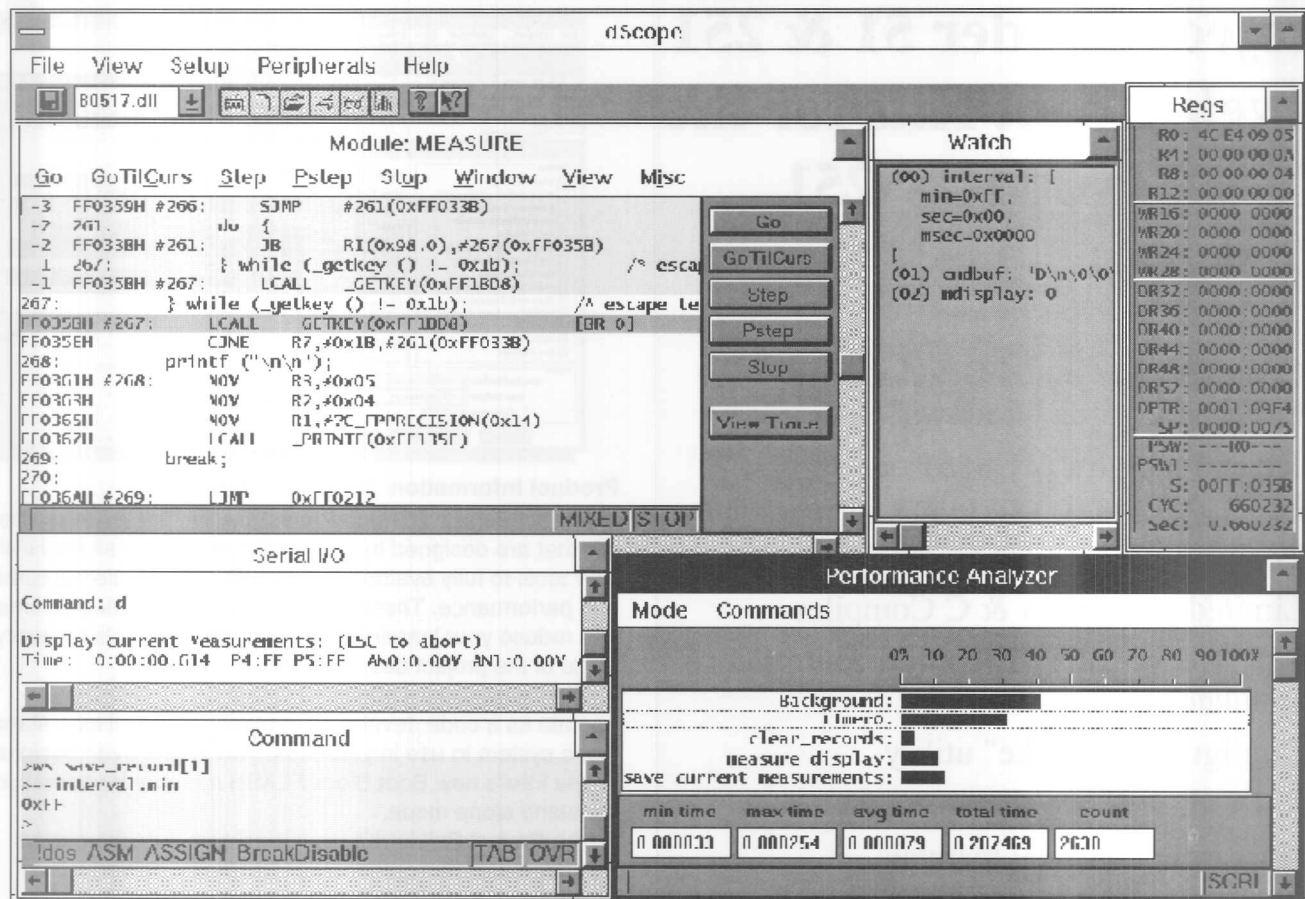


With the MS-Windows™ based 51/251 HLL Debugger / Simulator, you can begin your development cycle today!

(continued)

# MCS<sup>®</sup> 251 Microcontroller Development Tools

(continued)



Franklin Software, Inc. supports both the MCS<sup>®</sup> 51 and MCS<sup>®</sup> 251 microcontroller programming with a complimentary pair of powerful tool sets:

The C51 Compiler, A51 Macro Assembler, dScope-51 HLL Debugger / Simulator and RTX-51 Real-Time Executive are the industry standard tools for programming of all derivatives and variants of the 8051 microcontroller family.

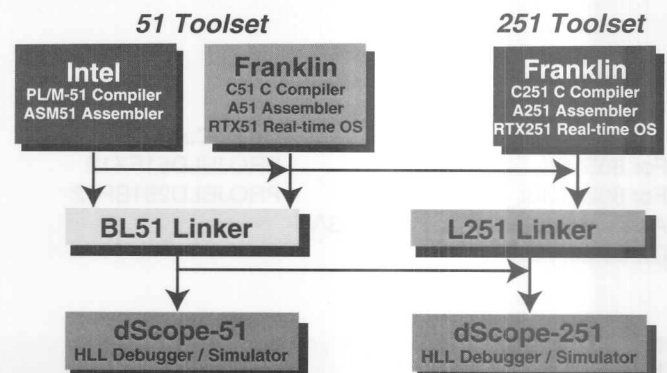
## Contact Information

Franklin Software, Inc.  
888 Saratoga Avenue, Suite #2  
San Jose, CA 95129  
Tel: (408) 296-8051  
Fax: (408) 296-8061  
Info: (408) 296-8056 (fax back)  
BBS: (408) 296-8060



These tools work well together with Intel PL/M-51 and ASM51. Since the MCS<sup>®</sup> 251 microcontroller is fully code compatible with the 8051 this toolset can also be used to directly generate high quality code for the MCS<sup>®</sup> 251 microcontroller.

The extended MCS<sup>®</sup> 251 microcontroller toolset (C251, A251, dScope-251 and RTX-251) takes full advantage of all MCS<sup>®</sup> 251 microcontroller instructions and addressing modes across the full 16MB MCS<sup>®</sup> 251 microcontroller address space.



## Project Builder 51 & 251

# Project Builder 51 & 251 Development Kits for the MCS® 51 & MCS® 251 Microcontrollers

- ▲ Complete Integrated Development Environment for Windows™
- ▲ Target board for MCS® 51 or MCS® 251 microcontrollers
- ▲ Configurable debugger
- ▲ Limited Assembler & C Compiler
- ▲ MCS® 51 or MCS® 251 microcontrollers simulators
- ▲ Configurable "Make" utility
- ▲ ApBUILDER programming tool
- ▲ Hypertext technical manuals
- ▲ CAD schematics & library
- ▲ H/W timing analysis S/W & library
- ▲ And at a reasonable price: \$182.51

### Ordering Information

Call Your Local Intel Distributor

For 8051FX:

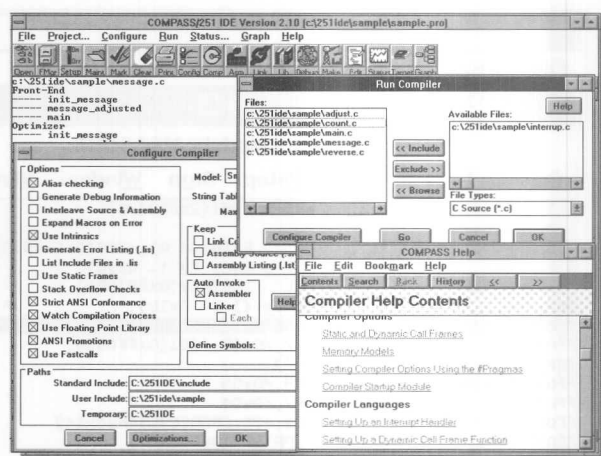
For 80251SB:

Also available with fuzzy logic S/W  
(See FuzzyBUILDER)

Order Codes:

PROJBLD51FX12

PROJBLD251BP12



### Product Information

Project Builder 251 and Project Builder 51FX are low cost kits that are designed to give design engineers all the H/W & S/W tools to fully evaluate the Intel Microcontroller features and performance. These turnkey kits save you design time and reduce your learning curve by providing tools for every stage of the project design cycle.

The Target Board offers maximum design flexibility to operate as a code development platform as well as a stand alone system to use in your prototype. It was even designed to use Intel's new Boot Block FLASH memory for operation in the stand alone mode.

The Project Builder Kits include a complete Integrated Development Environment commanding a powerful line of systems tools, an environment that includes Project Maintenance and graphical Program Analysis. Not only does this save you development time but its simulated multitasking environment allows you to create, suspend, resume, kill and monitor foreground and background tasks. You can perform other work while in the process of running a compile. The graphing features of the IDE allow you to view your project as a group of relationships rather than a list of files and functions. File dependency and function call graphs display your project in hierarchical format. The graphs are interactive. Simply double click on a graph node to: edit a file or function, set a breakpoint in the debugger, delete a file from your project, change the file in the debugger code window or view file information. In addition to these capabilities, the advanced Make utility determines which files have changed and what tools to use to build your finished application.

When you are ready to design your Hardware, the Kit includes interactive H/W timing models of the Intel Microcontrollers. It's like having a Data Sheet which allows you to perform "what if" timing analysis! Additionally, the Kit includes schematic files and libraries of several Intel 51 & 251 boards with a CAD viewer. Start your design with a working schematic to build on! With Project Builder, you'll be Working Smarter...NOT Harder!

### System Requirements

PC with DOS & Windows™ 3.1 or higher.  
RAM: Minimum to run Windows. 2MB or above.



## C251 Compiler

## C251 Compiler and Utilities

- ▲ ANSI C Compiler for all MCS® 251 microcontrollers
- ▲ Source code compatible to Keil C51 compiler; up to 15-times faster code
- ▲ Modern code optimization with seven levels and global register coloring
- ▲ Powerful MS Windows™ based source-level debugger
- ▲ Includes peripheral simulator for all popular 8051 & 251 derivatives
- ▲ MS Windows™ based IDE
- ▲ A251 Macro assembler, fully source compatible with A51 & ASM-51
- ▲ Can be intermixed with modules from Keil C51 version 5 and Intel PL/M-51

## Contact Information

Sales and Support Offices

USA &amp; Canada:

KEIL Software, Inc.

16990 Dallas Parkway, #120

Dallas, Texas 75248

Tel: (800) 348-8051

Fax: (214) 735-8055

Europe:

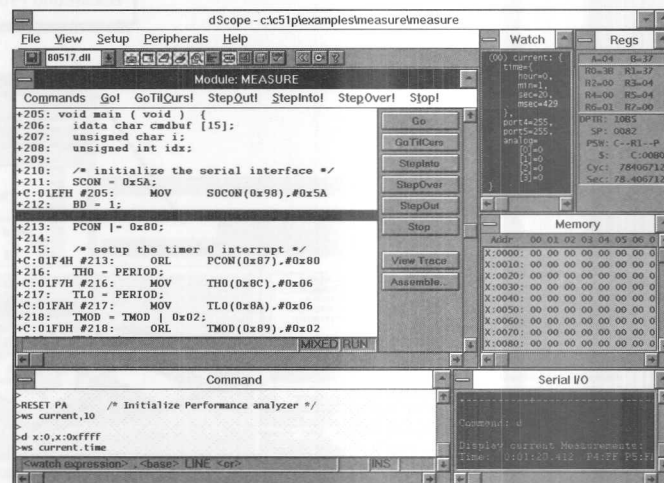
Keil Elektronik GmbH

Bretonischer Ring 15

D-85630 Grasbrunn

Tel: ++49 89 465057

Fax: ++49 89 468162


**KEIL**  
SOFTWARE


## Product Information

The Keil 251 toolset unlocks the power of the new Intel MCS® 251 microcontroller family. The 251 gives you up to five times faster 8051 code execution. C programs re-compiled with Keil C251 are up to 15 times faster! Upgrading from the 8051 to the 251 is fast and easy since the 251 toolset is fully compatible to Keil 8051 and Intel 8051 toolsets.

The Keil C251 Compiler is a dedicated ANSI C Compiler designed explicitly for the MCS® 251 microcontroller family. C251 provides full support for the 251 architecture and can access all system components. Variables can be explicitly located anywhere in the 251 address space. The linear 16M byte address space can be accessed with many addressing modes.

The powerful dScope-251 HLL debugger is a superset of dScope-51 with full support for both the 8051 and the 251 families. dScope-251 allows source level debugging with the option to review up to 512 executed instructions. The Code Coverage function automatically marks executed code and allows you to quickly see parts of your program that have not executed. The built-in Performance Analyzer records timing statistics of functions and program blocks. Extensive break capabilities combined with the C-style function language gives you full control of the program execution directly on your PC.

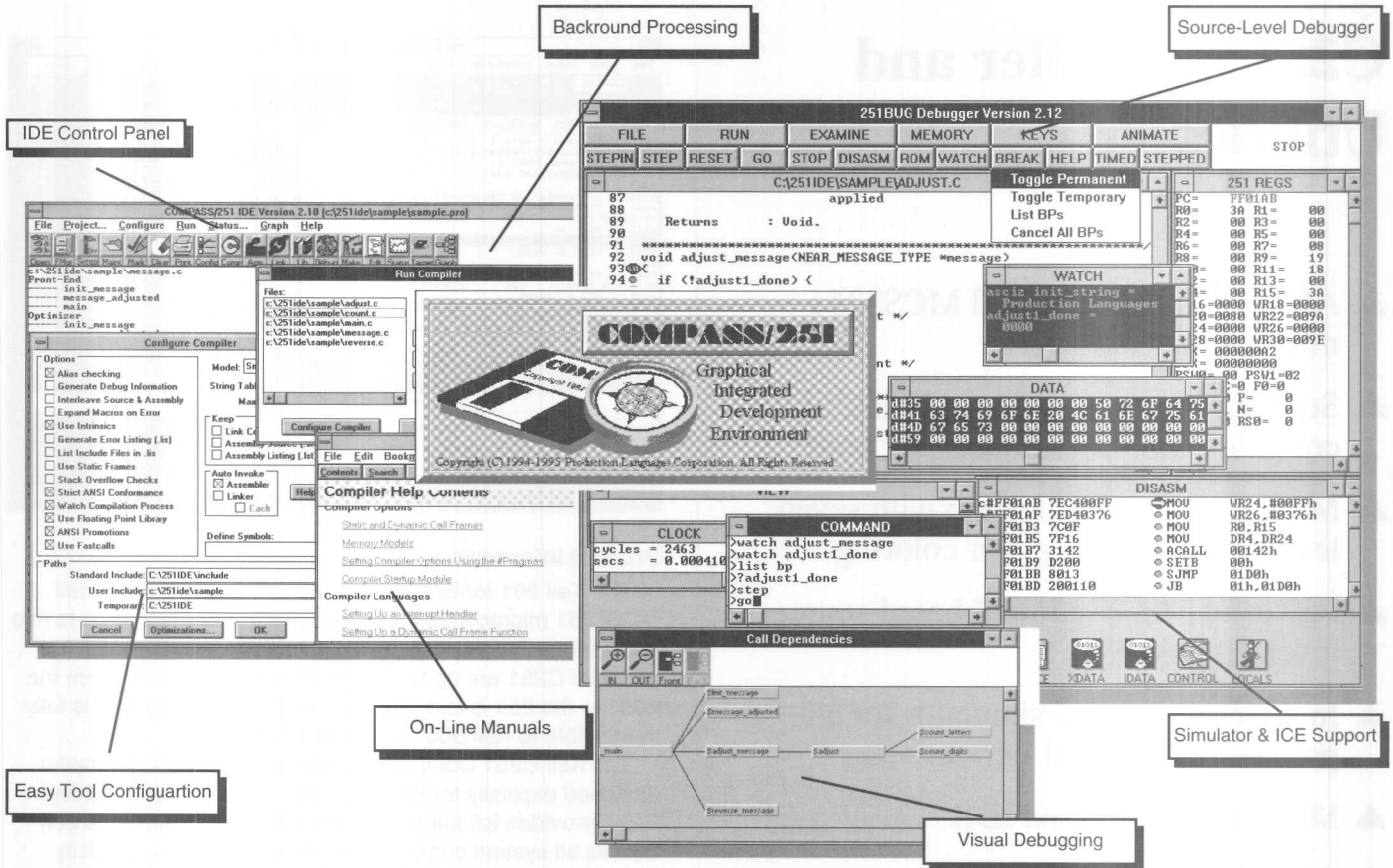
The Keil 251 toolset is an open platform which can be combined with all 251 emulators, Fuzzy Tools, and Real-Time Operating Systems from leading vendors.

## Ordering Information

For product details, free demonstration software and price information contact the Keil sales and support office.

Keil products are also available through our US distributors: Franklin Software, Nohau, MetaLink, and others.

Keil has more than 20 distributors and representatives in all parts of the world.



### The World's Hottest Windows™ Hosted 80251 IDE

PLC's COMPASS/251™ Integrated Development Environment for the Intel 80251 microcontroller is the hottest Windows™ hosted embedded software development system available. It offers a comprehensive toolset that includes an ANSI C Cross Compiler, Macro Assembler, Linker/Locator, Object Librarian, and Source-level Debugger.

### True Windows Interface Increases Productivity

COMPASS/251 has a true Microsoft® Windows™ user interface that dramatically increases your productivity. The COMPASS/251IDE efficiently manages your projects and allows you to compile, assemble, and link your programs in background mode, thus you can turn waiting time into productive time. Advanced Program Visualization capabilities provide you with a graphical representation of your application at both modular and functional levels.

### Optimizing Compiler Rivals Hand-coded Assembly

The COMPASS/251 ANSI C Compiler lets you optimize your code for speed or size. Advanced features including fast-calls, intrinsic, priority-based register graph coloring, and global optimizations produce code quality never before seen in any 8051 family compiler. Microsoft and Borland™ compatibility allows you to prototype your algorithms using familiar tools early in your products life cycle.

### Powerful Debugger and Simulator Make Finding Bugs a Cinch

The COMPASS/251 Debugger lets you debug your assembly and/or C code at the source level using an advanced feature set and visual debugging techniques. Popular emulators are supported without sacrificing features of the integrated environment. The COMPASS/251 Instruction Simulator also interfaces seamlessly to the COMPASS/251 Debugger. This simulator has been validated against the Intel 80251 VHDL model resulting in the most accurate simulation of the 80251 available.

### Contact Information

Production Languages Corporation  
P.O. Box 109  
Weatherford, TX 76086  
Tel: (800) 525-6289  
Tel: (817) 599-8363  
Fax: (817) 599-5098



## ProMaster 2500

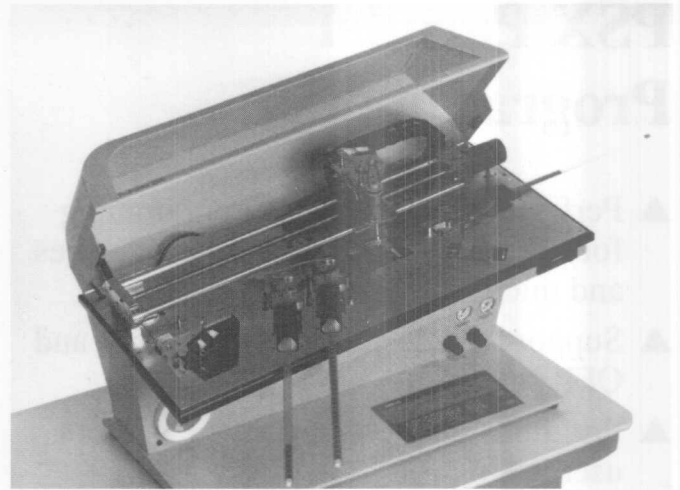
## ProMaster 2500 Production Programming System

- ▲ Programs, tests, labels, and sorts in a single-pass, tube-to-tube operation
- ▲ Pick-and-place device transport protects SMT and other devices against physical damage
- ▲ Change-overs from one package style to another can be done in two minutes or less — no tools or special skills are required
- ▲ Fully grounded device-contact surfaces guard against ESD damage
- ▲ Entire system is approved by semiconductor manufacturers to ensure highest programming yields and reliability
- ▲ Advanced pin electronics are tuned to ensure optimum signal fidelity and superior programming yields for high-speed devices
- ▲ Easy-to-use PC-based software provides integrated control of all system components, including the handler, programmer, and data source
- ▲ Detailed statistics of each programming session let you analyze programming trends and better manage quality

### Contact Information

Data I/O Corporation  
10525 Willows Road N.E. - P.O. Box 97046  
Redmond, WA 98073-9746  
Tel: (800) 3-DataIO (800) 332-8246  
(206) 881-6444 Fax: (206) 869-7423

# DATA I/O



### Product Information

Data I/O's ProMaster™ 2500 is a fully integrated, automated system for handling, programming, testing, sorting, and labeling programmable devices.

Providing universal support for devices in DIP packages up to 32 pins, PLCC packages up to 84 pins, and 300- through 525-mil SOIC packages with 14-44 pins, the ProMaster 2500 programs, labels, and sorts as many as 550\* devices per hour. Its state-of-the-art pick-and-place handling technology minimizes damage to delicate surface-mount devices for safe, high-yield SMT production. Automated tube-to-tube processing also eliminates human error and device damage, and minimizes any electrostatic (ESD) damage caused by human handling.

From input to output, the ProMaster 2500 is designed for flexibility. The pick-and-place head rotates devices, so programming and labeling proceed without interruption regardless of device orientation in the tubes. A high-density, dot matrix printer quickly prints and applies device labels, available in a wide variety of materials and sizes, in one swift and precise operation. Tube holders — one at the input and two at the output — accept any standard programmable integrated circuit (IC) tube without adjustments, and automatically center the tubes. Quick and easy changeovers dramatically reduce downtime and also enhance flexibility for just-in-time manufacturing.

The system is controlled by Data I/O's TaskLink™ Universal Production Automation Software for easy-to-use PC-based control. The result is a complete turnkey solution that improves the productivity, quality, and flexibility of your production process.

Data I/O also has three other ProMaster models featuring laser marking, tube-to-tape operation, and low-cost DIP-only capabilities for tailor-made production programming.

\* Actual throughput will depend upon programming/testing time and marking requirements.

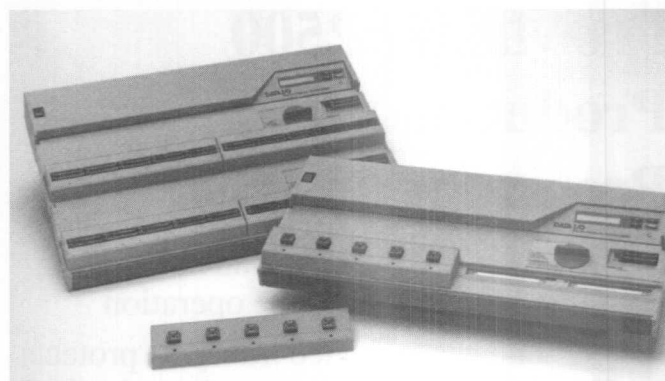
## PSX 500/1000

## PSX Parallel Programmeters

- ▲ Performs gang- and set-programming for EPROM, EEPROMs, Flash devices and microcontrollers
- ▲ Supports DIP, PLCC, SOIC, TSOP and QFP packages
- ▲ Programs from master device or from user RAM
- ▲ Includes TaskLink Software for the PC allowing for high-speed download of data
- ▲ Comes with manufacturer-approved and certified algorithms to assure the highest possible programming yields
- ▲ Complies with UL, CSA, and VDE product safety requirements and with FCC, VDE, and IEC EMI emission requirements

### Contact Information

Data I/O Corporation  
10525 Willows Road N.E. - P.O. Box 97046  
Redmond, WA 98073-9746  
Tel: (800) 3-DataIO (800) 332-8246  
(206) 881-6444 Fax: (206) 869-7423



### Product Information

Data I/O's PSX™ Parallel Programmeters provide the highest programming yield and lowest cost per part for any size production programming operation. All PSX programmers support both gang- and set-programming of EPROMs, EEPROMs, Flash devices, and microcontrollers in virtually any package type.

Three PSX models are available to fit your anticipated throughput needs. The entry-level PSX400™ programs up to eight devices at a time in DIP, PLCC, and PCMCIA packages. The intermediate PSX500™ programs up to 10 devices at a time in DIP, PLCC, SOIC, TSOP, QFP, and PCMCIA packages, and the top of the line PSX1000™ programs up to 20 devices at a time in all of the above-listed packages. All PSX programmers can operate as standalone stations or with a PC using our TaskLink™ programming process control software. Data can be downloaded serially at up to 112K baud, or via IEEE-488 at up to 170K bytes/sec, minimizing setup times.

High PSX programming yields are the result of many factors. Automatic power-on tests and on-board diagnostics constantly evaluate the PSX hardware and software to verify proper operation. Each programming operation begins with the following tests: device insertion test to verify proper part orientation, parts ID test to verify correct device type, blank check test to verify that parts are new or fully erased, and illegal bit check test to verify that a data pattern can be successfully programmed into a non-blank part. In addition, a one or two pass bit verify test and optional CRC test ensure that data patterns are programmed correctly. All PSX programming algorithms are certified by the device manufacturers to ensure that data retention times will be per the manufacturer's specification.

Data I/O has 20 years of experience building parallel programmers. From the high-speed pin-driver electronics to the durable sockets, the PSX is designed to withstand the demands of a tough manufacturing environment.

# DATA I/O



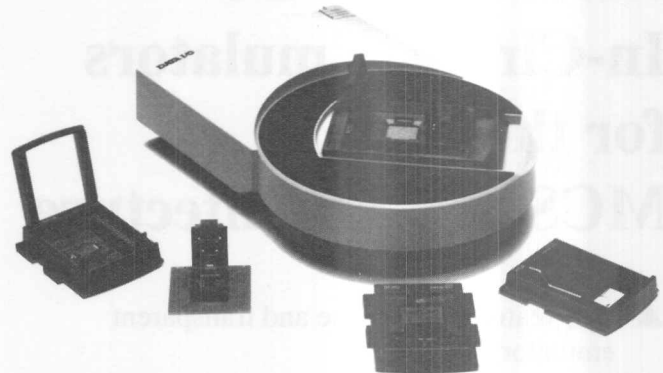
## 2900/3900 Programming Systems

- ▲ Programs microcontrollers, PROMs, EPROMs, EEPROMs, Flash, PLDs and FPGAs
- ▲ Provides up to 88 universal pin drivers and support for devices over 200 pins
- ▲ Supports DIP, PLCC, LCC, QFP, SDIP, SOIC, PGA, TSOP, and memory cards
- ▲ Provides parallel test vector application
- ▲ Provides serial set-programming
- ▲ Supports four modes of operation:
  - PC control using PROMlink™-6 including high-speed (115K baud) serial download
  - Terminal control
  - Portable control using QuickComm™ Interface
  - Computer Remote Control
- ▲ Automatically configures for host RS232 port and accepts over 45 I/O formats
- ▲ User-installed updates via disk
- ▲ Access to new device algorithms via BBS
- ▲ 2900 is fully upgradable to a 3900 system

### Contact Information

Data I/O Corporation  
 10525 Willows Road N.E. - P.O. Box 97046  
 Redmond, WA 98073-9746  
 Tel: (800) 3-DatIO (800) 332-8246  
 (206) 881-6444 Fax: (206) 869-7423

# DATA I/O



### Product Information

The 2900/3900 Programming Systems provide universal device support for your most advanced design while keeping programming costs down. The device programmers support thousands of FPGAs, PLDs, memory devices, and microcontrollers, up to 88 pins and beyond. For flexibility and affordability, this support is offered in device libraries, so you pay only for the support you need, when you need it. Start with a single device library and add additional libraries when you're ready. Or, buy the full set of libraries for comprehensive support up front.

With the proliferation of pinout standards, you can no longer predict which pins will need programming signals, power, or ground. That's why the 3900 has power and ground available on every pin. And, universal pin-driver technology automatically reconfigures the programming site for the device being programmed, so it can program virtually all devices in the same programming site.

For safe, easy handling of surface-mount devices (SMDs), the 2900 and 3900 feature Data I/O's MatchBook™ device carriers. Matchbooks are durable plastic carriers which accurately align the SMD in the programming site. Each MatchBook set accommodates an entire package family, replacing the traditional fragile, costly SMD sockets.

# iceMASTER-SC™

## In-Circuit Emulators for the Intel MCS® 251 Architecture

- ▲ Full-featured, real-time and transparent emulator
- ▲ Supports the Intel MCS® 251 architecture up to 20 MHz
- ▲ Supports 8xC251SB
- ▲ Supports 24-bit addressing
- ▲ Supports both binary mode and source mode (software selectable)
- ▲ Hardware features:
  - Standard 1MB emulation memory is expandable to 16M (optional)
  - 16K x 48-bit trace buffer
  - View trace while executing
  - Up to 128K real-time address breakpoints
  - Up to 64K real-time breakpoints (2-levels of break triggering supported)
  - Integrated self-test capabilities
- ▲ System features:
  - PC-hosted via standard RS 232 serial link or standard parallel port
  - Efficient, powerful, easy to learn
  - Windowed user interface with control of size, content, position, and color
  - Third-party Assembler and Compiler support
  - Full symbolic and source-level debug
- ▲ Full support for structures, unions, arrays and pointers

### Product Information

Designed for demanding projects, iceMASTER supports frequencies up to 20 MHz with up to 16M bytes of addressable emulation memory for code and data. A 16K x 48-bit transparent trace buffer with advanced searching capabilities is also available for real-time debugging capabilities. This includes the ability to view the trace buffer without the need to break the emulation cycle.

The iceMASTER windowed user interface delivers the highest development productivity. Its context-sensitive hypertext and hyperlinked help system makes this interface easy to learn and easy to use. This powerful, productive interface gives you total control and flexibility in the configuration of the size, position, content and color of each window.

The iceMASTER includes a full symbolic and source-level debugger for Assemblers and Compilers. The emulator supports the most popular Assemblers and Compilers.

### System Includes

Emulator, Interchangeable probe card, RS 232 or parallel cable and power supply.

### Host System

IBM, AT, 386, 486, Pentium® processor, PS/2, notebook, laptop, or a completely compatible system.

### Availability

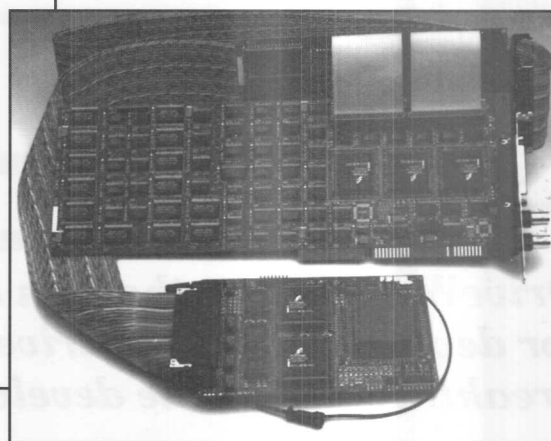
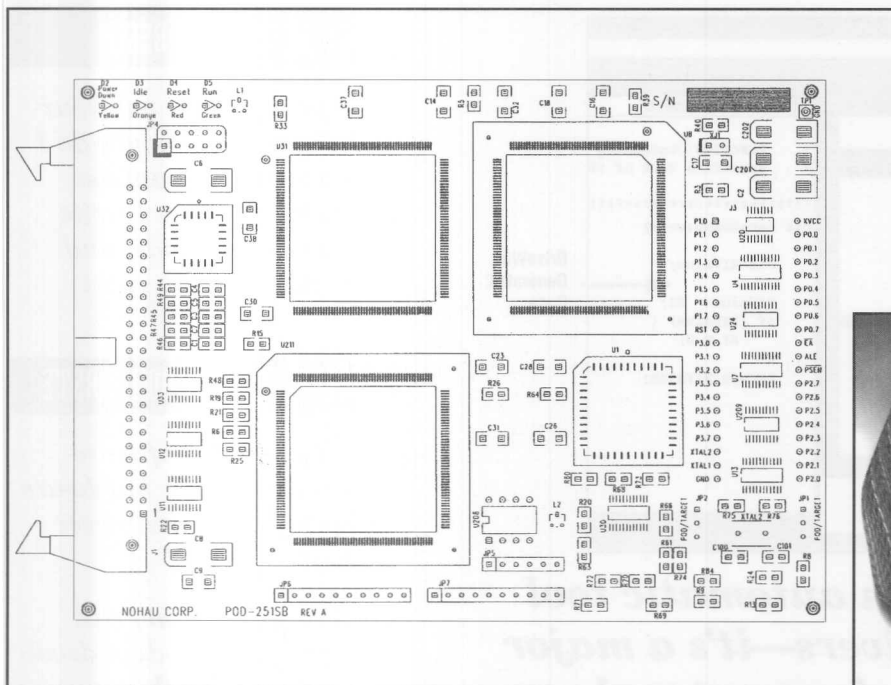
2Q 1995



### Contact Information

Your local Metalink Sales Office or Distributor  
 MetaLink Corporation  
 325 E. Elliot Road  
 Chandler, AZ 85225  
 Tel: (602) 926-0797  
 Fax: (602) 926-1198

## New In-Circuit Emulator for Intel's MCS® 251 Architecture



Nohau Corporation, the market leader for in-circuit emulators (over 10,000 EMUL-51PC emulators have been shipped since 1986), announces the new EMUL251™-PC emulator for Intel's MCS® 251 microcontrollers.

### Contact Information

Nohau Corporation  
51 E. Campbell Ave.  
Campbell, CA 95008  
Tel: (408) 866-1820  
Fax: (408) 378-7869

**NOHAU**  
CORPORATION

### Product Information

The EMUL251™-PC will consist of a board which plugs directly into an IBM PC/AT bus. For those using Workstations such as Sun or HP, Nohau's LanICE is also available.

The probe, or pod, will be connected to the emulator board with a five foot ribbon cable, and will plug into the system under test through the use of an adapter.

An optional trace board will hold up to 512k trace records, each 104-bits wide. This trace board will have multiple trigger levels, filtering, loop counting and 40-bit time stamping.

The user interface will run under Microsoft® Windows™ and will support symbolic assembly as well as high-level C debugging.

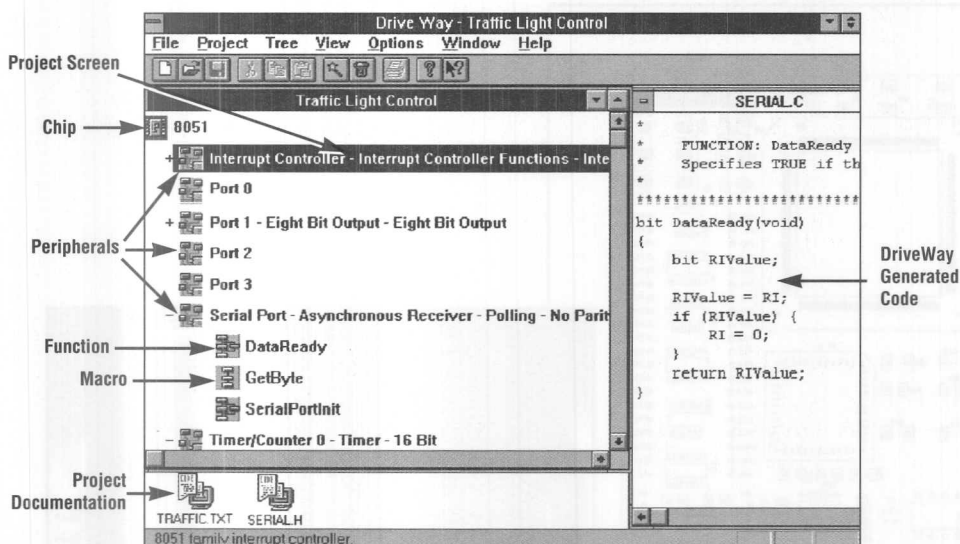
### Product Availability

The emulator is expected to be ready for beta testing May 1995.

See page 165 for Nohau's representative in your area.

# DriveWay<sup>TM</sup>

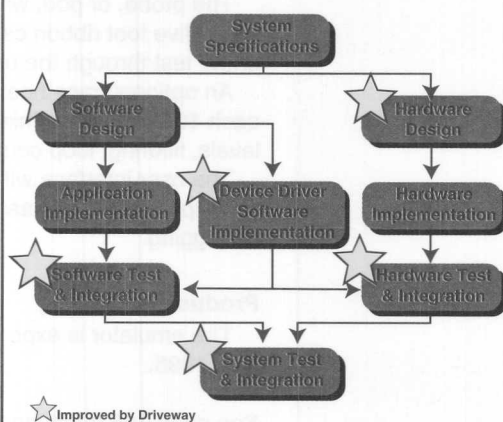
## Code Generation Tool for 8051 Embedded Development



***DriveWay is more than an automatic tool for developing device drivers—it's a major breakthrough in the development cycle.***

- ★ Speed up the development process by automatically generating code to initialize the system.
- ★ Eliminate the need to manually code and debug device drivers, initialization routines, interrupt routines and test functions.
- ★ Select from a library of systems modules simply through "pointing and clicking", this interconnects the systems functions supported by the 8051.
- ★ DriveWay automatically produces the C Code drivers and documentation to support the 8051 design!
- ★ DriveWay can be integrated with the industry's leading development toolset—the Franklin 8051 tools! In addition, DriveWay also supports: Archimedes, BSO, and Keil, among others.

### DriveWay Functions



*The typical embedded system development process is shown above. The ★ indicates those functions of your development cycle that can benefit dramatically with DriveWay.*

### BEFORE YOU BEGIN

*your next project, ask yourself: "how many hours do I spend reading countless data sheets before I write my first line of code, and then, does it work right away?"*

### HOW MUCH TIME DO I WASTE

*searching for a software bug or debugging hardware using software that never actually worked?*

*With DriveWay, you can improve your product development cycle while you develop consistent and reliable code!*

### MAKE THE ADVANTAGE YOURS

*Put DriveWay to work for you today, and spend tonight sleeping instead of searching for a bit that wasn't handled correctly!*

**CALL FOR YOUR FREE DEMO  
TODAY!**

**FRANKLIN  
SOFTWARE, INC**

888 Saratoga Avenue, Suite #2  
San Jose, CA 95129  
Tel:(408) 296-8051  
Fax:(408) 296-8061  
Info:(408) 296-8056 (fax back)  
BBS:(408) 296-8060



# Section III

## MCS<sup>®</sup> 51 Microcontroller Development Tools

COMPANY	PRODUCT	MCS® 51	MCS® 251	MCS® 96	80C186	PG.
		ARCHITECTURES				
Software Development Tools						
Archimedes Software	C-8051 v5.0 & SimCASE	X	X			54
Avocet Systems	AvCASE51 Embedded Software Dev. Pkg.	X				55
BSO/TASKING	Total 8051 Family Development Solution	X				56
BSO/TASKING	CrossView 8051 Debugger	X				57
BSO/TASKING	8051 Assembler	X				58
ChipTools	ChipView-51 High/Low-Level Debugger	X				59
Chronology	TimingDesigner	X	X	X	X	60
Cimetrics Technology	9-Bit Solution Microcontroller Network	X		X	X	61
CMX Company	CMX-RTX, CMX-TINY, and CMX-TINY+ RTOS	X	X	X	X	62
Franklin Software	BL51 CODE Banking Linker	X	X			63
Franklin Software	RTX51 Real Time Operating Systems	X	X			64
Franklin Software	DS51 Source Level Debugger/Simulator	X	X			65
Franklin Software	8051-DriveWay Code Generation Tool	X				66
Franklin Software	MCS® 51, MCS® 251 Microcontroller Software Development Tools	X	X			67-68
Franklin Software	ProView Turbo Tools	X	X			69-70
Franklin Software	A51 Macro Assembler Kit	X	X			71
Franklin Software	DK51 Complete 8051 Developers Kit	X	X			72
Franklin Software	PK51 Professional Developers Kit	X	X			73
Franklin Software	C51 C Language Compiler	X	X			74
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HiTech Equipment Corp.	8051 Family Single Board Computers	X				85
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Lauterbach Datentechnik	TRACE32 In-Circuit Emulator	X				88
Logical Devices	XPRO Universal Programmers	X				89
Logical Systems	8051 Programming Adapters & Sockets	X				90
Metalink	iceMASTER-AA™ In-Circuit Emulators	X				91
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Nohau Corporation	EMUL51-PC In-Circuit Emulator	X				93-95
Nohau Corporation	ChipView-51	X				96
Signum Systems	USP-51 In-Circuit Emulator	X		X	X	97
Tektronix	32GPX/DM01, TLA510 & 92DM901	X				98

## Archimedes IDE-8051

## C-8051 v5.0 & SimCASE 8051 for Maximum 8051 Power

- ▲ C-8051 v5.0 (100+ derivatives) is at least 25% more code efficient than competition
- ▲ SimCASE - C/ASM debug & simulation for 100+ derivatives
- ▲ Macro Assembler
- ▲ Optimizing Linker
- ▲ Librarian & ANSI libraires
- ▲ Complete development front-end including editor
- ▲ DOS/Windows™ support
- ▲ All popular emulator & third party tools supported
- ▲ 1200+ pages of documentation including tutorials and examples

### Contact Information

Archimedes Software, Inc.  
303 Parkplace Center, Ste 125  
Kirkland, WA 98033  
Tel: (206) 822-6300  
Fax: (206) 822-8632  
CompuServe E-Mail: 72662,1601  
Internet E-Mail: 72662.1601@CompuServe.com



ARCHIMEDES  
SOFTWARE



### Product Information

#### Top Speed & Size Efficiency

Archimedes C-8051 v5.0 is the most code efficient compiler available today, worldwide. We now win all the benchmarks by impressive margins.

#### Most Features

Archimedes C-8051 v5.0 supports 100+ derivatives and has the most powerful features - 100% Intel ASM/OMF compatibility, flexible memory models supporting static and reentrant code, memory specific and generic pointers to maximize code speed, 9 data types supported including 32-bit IEEE floating point, easy and fast interrupt handling directly in C, bit addressable objects among several others.

#### SimCASE - Real Time/Simulator C/ASM Debugging

Archimedes SimCASE v5.0 simulator implements the full instruction set as well as accurate timing and I/O manipulation. The debugger allows comprehensive C & ASM debugging.

#### Archimedes Guarantee

Archimedes was the first company to introduce the PC based ANSI C Cross compiler for the Intel 8051 family back in 1985. Since then, Archimedes Software has dedicated itself by specializing in the microcontroller software market and has developed a unique competence in C compilers & Simulator/Debuggers construction for embedded applications. Archimedes offers you the most responsive technical and customer hotlines in the industry.

#### Host Systems Supported

PC (DOS 5.1/WIN 3.1)

#### Ordering Information/Product Information

Call (800)-338-1453. Visa and MasterCard are accepted.

#### Product Ordering Number

Archimedes IDE-8051

## AVCASE51

## AvCase II 8051 Embedded Software Development Package

- ▲ ANSI standard optimizing C compiler
- ▲ Compiled-stack optimization
- ▲ IEEE695 compatibility w/leading ICE Vendors
- ▲ Bank switching
- ▲ Full-featured macro assembler/linker
- ▲ Powerful and flexible high-level simulator debugger
- ▲ ROM monitor debugger
- ▲ Project-build utility
- ▲ GUI-based integrated development Environment
- ▲ On-line context sensitive help

### Contact Information

Avocet Systems, Inc.  
120 Union Street  
P.O. Box 490  
Rockport, Maine 04856  
Tel: (800) 448-8500  
Tel: (207) 236-9055  
Fax: (207) 236-6713

**AVOCET**  
SYSTEMS®, INC.



### Product Information

AvCase II is an integrated set of development tools which turns your PC into an efficient working environment for embedded system software development. Using the AvCase II Integrated Development Environment (IDE), everything is only a mouse-click (or keystroke) away— editor, C compiler, assembler, linker, utilities, high-level simulator debugger, high-level remote monitor debugger, on-line reference manual and project builder. You can even add your own tools to the AvCase IDE, such as your favorite editor, EPROM programmer or ICE. The heart of the package, though, is Avocet's robust & full-featured C compiler and assembler. AvCase II's C compiler features compiled-stack optimization, a technique for producing tighter and faster code. Add to that our versatile AVA Macro Assembler, and you have an unbeatable development combination. For added power and versatility, source code for all libraries and startup routines is included. When debugging is necessary, our new high-level simulator debugger has power to spare. In fact, there is not a more complete 8051 simulator debugger available! We can say this in part, because ours is compatible with the output of all of the major C compilers out there! User-defined menus and port-assignments along with the fully-configurable front-end make AvCase II 8051 a must for any serious developer.

### Processors Supported

All 8051 derivatives

### Host Systems Supported

386 or better PC's & compatibles

### Ordering Information

Orders may be placed by telephone, mail or fax. Please state desired diskette size when ordering by mail or fax. We accept Visa, Mastercard, American Express, checks, money orders & wire transfers. Purchase orders require prior credit approval. Please call for more details or for product literature and a demo diskette.

## C 8051 Tools

## The Total 8051 Family Development Solution

- ▲ Highly optimizing ANSI C compiler package producing the tightest, fastest code in the industry, bar none!
- ▲ Powerful macro assembler and linker/locator generates ROMable, relocatable and reentrant code for optimum flexibility
- ▲ CrossView Windows debugger with target ROM or Simulator for debugging in C, PL/M and assembly language
- ▲ Complete ANSI C libraries in source, and run-time support libraries
- ▲ Supports 4 memory models: small, large, auxpage and reentrant
- ▲ Mixed memory model programming
- ▲ Very efficient IEEE single precision floating point math support
- ▲ Support for all 8051 derivatives - 100+
- ▲ Support hotline only a toll free call away

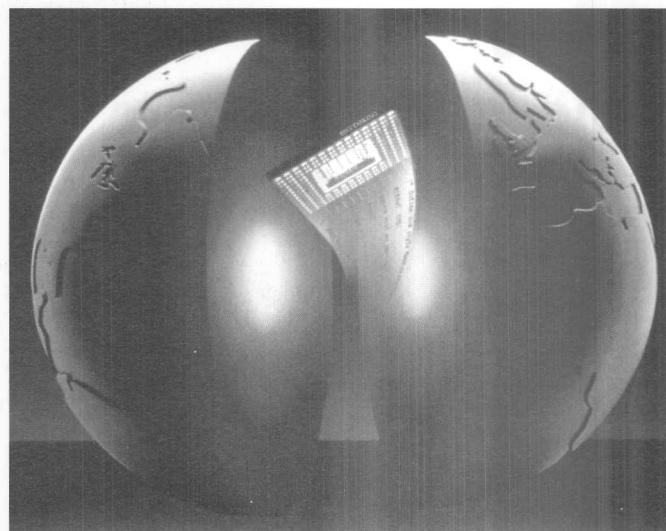
### Contact Information

TASKING Netherlands	Tel: +31 33 558584
TASKING Germany	Tel: +49 7152 939630
TASKING Italy	Tel: +39 2 6698 2207
Nihon TASKING Japan	Tel: +81 3 3780 0916
BSO/TASKING UK	Tel: +44 1252 510014

**BOSTON  
SYSTEMS  
OFFICE  
TASKING**

### Contact Information

BSO/TASKING  
333 Elm Street  
Dedham, MA 02026  
Tel: (617) 320-9400  
Tel: (800) 458-8276  
Fax: (617) 320-9212



- ▲ Support for in-line assembly and in-line expansion of predefined functions for efficiency
- ▲ Compact, high performance kernel with 13 services, upgradeable to 67 power packed services
- ▲ Context sensitive help and on-line user manuals
- ▲ Embedded Development Environment lets users access all tools through a common windows interface

### BSO/TASKING

One supplier, one support hot line, one company... Established in 1974, BSO/TASKING pioneered the concept of cross development on mini computer systems. Today BSO/TASKING has 100 dedicated individuals who are focused on providing high quality solutions for the embedded systems developer across all computer platforms.

Customer satisfaction comes first at BSO/TASKING. We provide a toll free hot line for orders, asking technical questions, and reporting problems. Our products include a 90 day warranty. Comprehensive technical support can be continued by enrolling in our Maintenance Plan, which entitles you to all future releases including product updates and feature enhancements. Ask our competitors what they charged for their last update!



## Crossview® 8051 Debugger

## The Ultimate 8051 Debugging Solution

- ▲ Multiple execution environments; high speed simulator, and ROM monitor to support all phases of design and testing
- ▲ Real Microsoft® and X Windows/Motif interface, lets you navigate around your code with point and click techniques together with keyboard shortcuts
- ▲ Code in C debug in C. Lets you debug optimized code and supports assembly level debugging
- ▲ Full trace including C level, assembly level and stack tracing
- ▲ I/O simulation using files or windows
- ▲ Supports complete 8051 family
- ▲ Context sensitive help and on-line user manuals
- ▲ Support hotline only a toll free call away

### Contact Information

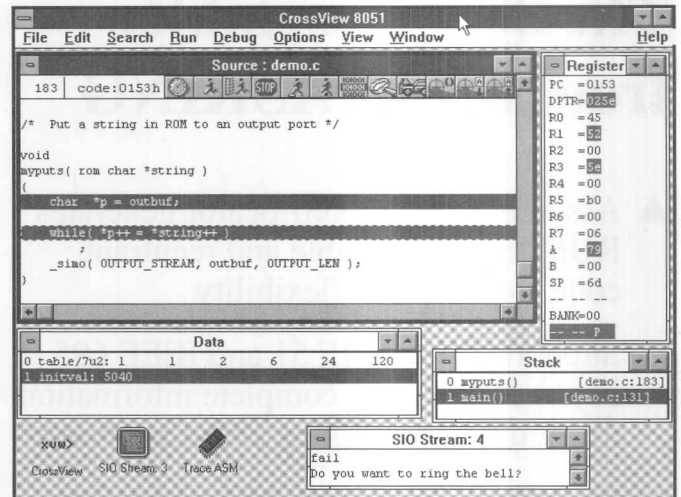
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### Product Information

BSO/TASKING supplies debuggers designed to deliver functionality that will reduce the time spent testing and debugging.

The BSO/TASKING debugger CrossView® not only displays your source code but uses the debug information that the C compiler generates, such as variable and function scoping and typing, including pointers, structures, enumerated types, bitfields and arrays.

There are plenty of views to choose from: source level code, monitor, inspect, on-chip registers, call stack, variables, break point, execution trace, session log, simulated I/O, memory dumps. Multiple overlapping windows can be moved and resized to suit you. Full screen zoom is only a mouse click away.

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## Assembler 8051

## The 8051 Assembler from BSO/TASKING

MCS® 51 MICROCONTROLLER DEVELOPMENT TOOLS

- ▲ Assembler and linker/locator generates ROMable, relocatable and reentrant code for optimum flexibility
- ▲ Supports Intel OMF 51 and IEEE 695 object format with complete information for symbolic debugging with CrossView®
- ▲ Intel compatible assembler and linker
- ▲ Powerful macro preprocessor
- ▲ Assembler optimizes 'jmp' and 'call' instructions
- ▲ C51 function overlaying by the linker reduces allocated on-chip RAM
- ▲ Support for all 8051 derivatives, 100+, using special function register files
- ▲ Compatible with your favorite emulator
- ▲ Support hotline only a toll free call away

### Contact Information

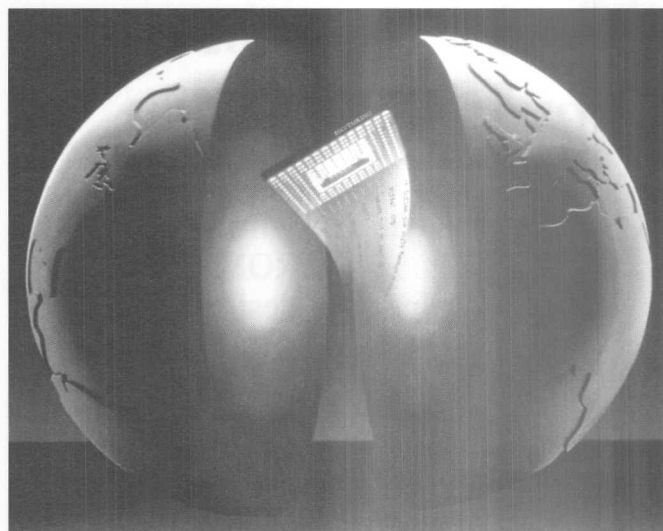
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Tel: +44 1252 510014

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OFFICE**  
  
**TASKING**

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Dedham, MA 02026  
Tel: (617) 320-9400  
Tel: (800) 458-8276  
Fax: (617) 320-9212



- ▲ Many utilities included: library manager, cross reference, object conversion utility
- ▲ Context sensitive help and on-line user manuals
- ▲ Embedded Development Environment lets users access all tools through a common windows interface

### BSO/TASKING

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## ChipView®-51

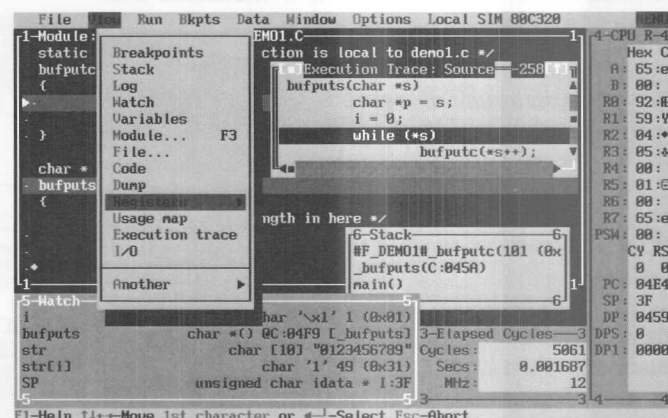
# ChipView®-51

## High-Level/Low-level Debugger

- ▲ No Learning Curve
  - ChipView-51 is key-compatible with Borland's popular Turbo Debugger
- ▲ High-Level support for C compilers, PL/M and Assemblers from Archimedes, Franklin, IAR, Intel, Keil and Tasking
- ▲ Point & Click to toggle breakpoints, or to watch or inspect C expressions with a mouse, menus or hot-keys
- ▲ C-Level Debug displays C Call Stack and C data browsers with full variable data type & scope information
- ▲ Fully Interactive VGA+ Windows
  - Over 14 different Views can be overlapped, moved, and resized
- ▲ One-key 'Build' launches the 'Edit-Recompile-Reload' loop and on return totally restores user's debug context
- ▲ 3 engines behind a common User Interface support all phases of design & testing: High-Speed Simulator, Emulator, and ROM monitor

### Contact Information

ChipTools Inc.  
 1232 Stavebank Road  
 Mississauga, Ontario, Canada L5G 2V2  
 Tel: (905) 274-6244  
 Fax: (905) 891-2715  
 BBS: (905) 891-3095  
 Internet: chiptool@hookup.net



Turbo C programmers can move to debugging 8051 embedded C instantly, as ChipView-51 is key-compatible with Borland's popular Turbo Debugger. It is available with a High-Performance Simulation engine, a ROM monitor engine, or interfaced for popular 8051 emulators.

ChipView-51 is the only 8051 debugger to support all popular 8051 C compilers at high-level. Unlike debuggers that support only simple data types, ChipView-51 lets you browse through C structures, unions, enumerations, bit-fields, pointers and arrays. With ChipView-51 you can simply point & click your way along a linked list!

ChipView-51's High-Performance Simulator Engine achieves the real-time speed of a 12 MHz 8051 when run on a 33 MHz 486 PC. It is ideal for testing entire programs before the target hardware is ready, with up to 32 banks! Off-chip I/O can be simulated by files or keypresses. And you can attach to real-world I/O for in-circuit simulation or serial I/O via COM ports.

The ROM monitor includes full source code of the 700 byte 8051 kernel, so that you can embed debug support into every product you ship – royalty free! The Emulator version is tailored to fully support Nohau's trace, emulator and bank-switch boards, and provides the extra power to trace 256K of source lines, mixed with a full trace of selected functions, all chosen by point & click!

### Support

- MS-DOS, OS/2, Windows™ 3.x, Desqview
- IBM AT or compatible with 3MB RAM
- All 8051 derivatives
- Custom version for Nohau's EMUL51-PC emulator
- High-level support for C compilers from Archimedes, BSO/Tasking, Franklin, IAR and Keil
- Source-level support for Assemblers and PL/M-51 compilers from Intel. Others supported at OMF51

### Warranty

All ChipTools products have a 30-day money-back guarantee, and one year of free updates and technical support to registered users.

### Ordering Information

CV51-S ChipView-51 High-Performance Simulator  
 CV51-M ChipView-51 ROM Monitor Debugger  
 CV51-NOH Nohau Emulator Debugger  
 CV51-C ChipView-51 COMBO Package of All  
 CALL for a FREE WORKING DEMO

# TimingDesigner® . . . The Best Way to Specify and Analyze Timing

for Windows™ and UNIX

Interactive Databooks are now included with Project Builder from Intel

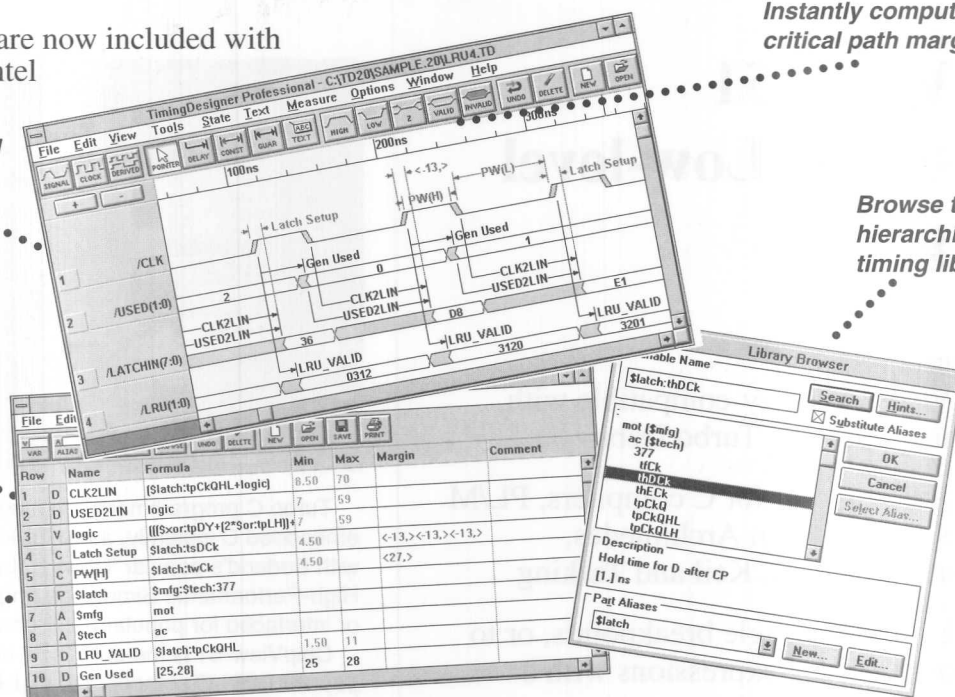
Accurately model complex timing requirements

Instantly compute critical path margins

Browse the hierarchical timing libraries

Changes to timing parameters instantly update diagram

Automatic part swapping



- ▲ Create and analyze timing diagrams
- ▲ Compute worst-case timing margins
- ▲ Instantly see the effects of design tradeoffs
- ▲ Analyze the interface between complex chips
- ▲ Visualize timing relationships in complex clock trees
- ▲ Communicate timing specifications to other designers

**Call us today for a FREE evaluation kit!**

## Contact Information

Chronology Corporation  
17411 NE Union Hill Rd., #100  
Redmond, WA 98052 USA  
Tel: (206) 869-4227  
Tel: (800) 800-6494  
Fax: (206) 869-4229  
Email: sales@chronology.com



## What is TimingDesigner?

TimingDesigner is software for accurately modeling, visualizing, analyzing, and documenting digital circuit timing.

Over 10,000 engineers at almost every major electronics company in the world use TimingDesigner. It's the most widely used timing specification and analysis software ever developed. TimingDesigner is used with any type of design — chip, board, or system — where timing is important, or where accurate timing and interface specifications must be communicated to others.

TimingDesigner models complex digital circuit timing by combining an interactive timing diagram editor with a special purpose timing spreadsheet.

The engineer first creates a timing diagram with the timing diagram editor, which shows the waveforms (sequence of events), delays (cause-and-effect relationships), and timing constraints of a proposed design.

The spreadsheet is then used to enter the min/max values of each delay and constraint. These values may be complex formulas — including min/max variables — so that path delays, different rise/fall times, loading, temperature, and other effects can be accurately modeled.

After each modification, TimingDesigner's static timing engine traces all of the delay paths specified in the timing diagram, removes common delays, adjusts for delays which track, selects the critical paths, and then computes the worst-case timing margins by comparing the total delay along each critical path to the minimum or maximum allowable value specified in each constraint. One of the things engineers like best about TimingDesigner is that the effects of design changes are seen instantly. Far more alternatives can be evaluated in a short time than with any other method.

## Microcontrollers Supported

MCS®51, MCS®251 and MCS®96 microcontrollers, and 80C186 embedded processors.



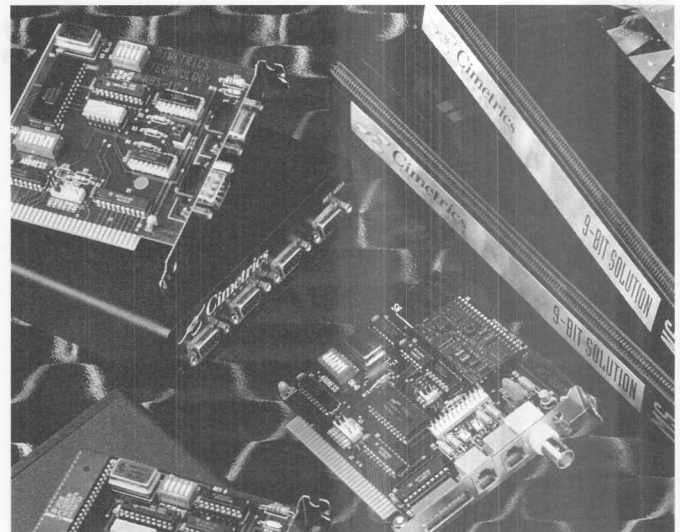
## 9-Bit Solution

## 9-Bit Solution Microcontroller Network $\mu$ LAN

- ▲ Comprehensive  $\mu$ LAN network
- ▲ MCS<sup>®</sup> 51 and MCS<sup>®</sup> 96 microcontrollers, and 80186 embedded processor compatible
- ▲ Support for a full range of other processors
- ▲ Uses microcontroller's built-in serial port (up to 125K baud)
- ▲ PC support using interface card
- ▲ Up to 250 nodes
- ▲ 16-bit CRC error checking with sequence numbers
- ▲ Low network overhead and low resource requirements
- ▲ Low cost/development time
- ▲ Complete source code included
- ▲ Comprehensive documentation

### Contact Information

Cimetrics Technology  
55 Temple Place  
Boston, MA 02111-1300  
Tel: (617) 350-7550  
Fax: (617) 350-7552



### Product Information

Cimetrics Technology's 9-Bit Solution provides innovative and cost-effective hardware and software for networking popular 8- and 16-bit microcontrollers. The 9-Bit Solution is a family of products that takes full advantage of the multiprocessor communication modes built into microcontrollers. The 9-Bit Solution allows simple and inexpensive development of master/slave multidrop embedded controller networks that are ideally suited for data acquisition and control applications.

The 9-Bit Solution family of products includes powerful master node software (PC or microcontroller), slave-node software, and a flexible RS-485 interface card for the PC. The fully documented 9-Bit Solution network software includes C-language libraries for the master node, assembly language software for several different slave microcontrollers, and clearly written sample programs. Our software saves time in the design and development of microcontroller networks by freeing you from the formidable task of writing network software.

### Support

The 9-Bit Solution currently supports these microcontrollers:

- 8051 family
- 8096 family
- 80C186EB/EC

### New Products

Cimetrics Technology is proud to introduce new products for 1995: the flexible ARCNET Solution family and the powerful Microcontroller Master software. The ARCNET Solution family includes interface cards that operate at up to 2.5M baud using the popular peer-to-peer ARCNET protocol. The newest member of the 9-Bit Solution, the Microcontroller Master software, allows you to construct networks that contain only microcontrollers. Call us today for more information on these exciting new products.

CMX-RTX,<sup>TM</sup> CMX-TINY,<sup>TM</sup> CMX-TINY+<sup>TM</sup>

# Real-Time Multi-Tasking Operating System For Microprocessors and Microcomputers

- ▲ Supports nested interrupts
- ▲ No royalties on embedded code
- ▲ All source code supplied
- ▲ Extremely fast context switch times
- ▲ Very low interrupt latency times
- ▲ Several "C" vendors supported
- ▲ Scheduler and interrupt handler written in assembly for speed and optimization
- ▲ All CMX functions contained in library
- ▲ Easily interfaces to assembly language
- ▲ User configurable
- ▲ Task management
- ▲ Event management
- ▲ Timer management
- ▲ Message management
- ▲ Circular queue management
- ▲ Resource management
- ▲ Fixed block memory management
- ▲ Specialized UART management
- ▲ Automatic power down management
- ▲ Full pre-emption and ability to also have cooperative and time slice scheduling

**CMX**  
COMPANY

## TASK MANAGEMENT

Create a task.  
Remove a task.  
Start a task.  
Suspend a task, with time-out provision.  
Wake a suspended task.  
Forcefully wake a task.  
Change a task's priority.  
Terminate a task early.  
Do a cooperative rescheduling.  
Disable task scheduling.  
Enable task scheduling.

## EVENT MANAGEMENT

Wait on event(s), with time-out provision.  
Set an event.  
Clear an event.

## QUEUE MANAGEMENT

Create a circular queue.  
Reset queue to empty.  
Add to top of queue.  
Add to bottom of queue.  
Remove from top of queue.  
Remove from bottom of queue.

## UART MANAGEMENT

Initialize UART.  
Put UART char, with time-out provision.  
Put UART string, with time-out provision.  
Get UART char, with time-out provision.  
Get UART string, with time-out provision.  
Update UART buffer(s).  
Initialize UART buffer(s).

## TIMER MANAGEMENT

Create a cyclic timer.  
Change a cyclic timer event parameters.  
Start a cyclic timer.  
Restart a cyclic timer.  
Restart a cyclic timer, with new initial time period and/or new cyclic time period.  
Stop a cyclic timer.

## MEMORY MANAGEMENT

Create a fixed block pool.  
Request free block from pool.  
Release block back to pool.

## RESOURCE MANAGEMENT

Get a resource.  
Reserve a resource, with time-out provision.  
Release a resource.

## MESSAGE MANAGEMENT

Get a message.  
Wait for a message, with time-out provision.  
Send a message.  
Send a message, wait for reply.  
Wake task that sent message, if waiting on reply.  
Wait on mailbox(es), with time-out provision.

## SYSTEM MANAGEMENT

Initialize CMX.  
Enter CMX.  
Enter interrupt.  
Exit interrupt.  
Enter power down mode.

## DEBUGGER

CMXBug<sup>TM</sup>

## TASK FLOW ANALYZER

CMXTracker<sup>TM</sup>

## Contact Information

CMX Company  
19 Indian Head Heights  
Framingham, MA 01701  
Tel: (508) 872-7675  
Fax: (508) 620-6828

CMX also supports other microcomputers and microprocessors.

## BL51—A Powerful 2MB CODE Banking Linker

- ▲ Flexible configuration to accommodate a wide variety of bank switching schemes
- ▲ Requires only 2 bytes of stack space
- ▲ Fast! Switches banks in less than 50 processor cycles
- ▲ Easily manages up to 32 banks across 2 megabytes
- ▲ No re-compiling or re-assembly required—Just re-link!
- ▲ Directive and functionally compatible with L51
- ▲ Even existing Intel ASM51 and PL/M-51 modules can be “banked”

### Contact Information

Franklin Software, Inc.  
 888 Saratoga Avenue, Suite #2  
 San Jose, CA 95129  
 Tel: (408) 296-8051  
 Fax: (408) 296-8061  
 Info: (408) 296-8056 (fax back)  
 BBS: (408) 296-8060



### Product Information

As increased hardware and software needs and capability push back the functional limits of the 8051 family, the challenge for increased program space has been met with this new and enhanced linker. In addition BL51 fully supports the needs of both RTX51 Tiny, and RTX51 Professional.

BL51 comes complete with a flexible configuration file that can be used to adapt to a wide variety of bank switching hardware and software schemes.

BL51 is a CODE bank switching linker that permits 8051 program development where code requirements exceed the natural 64KB addressing limit of the 8051 family of microcontrollers.

### Function

BL51 manages up to a maximum of 32, 64KByte code banks. The designated common area is accessible to all banks. Code destined for the common area may be duplicated in each bank if the hardware is not designed for a common area, or if the common area of the hardware in use is too small. Among those code sections typically relegated to the common area(s) are:

- RESET and INTERRUPT VECTORS
- CODE constants
- INTERRUPT Function code
- Bank Switch code, and the associated jump table
- Intrinsic Library functions

BL51 automatically generates and inserts a jump vector for program calls to different code memory banks. BL51 analyzes the complete application program and inserts inter-bank or intra-bank jumps only when this is really necessary. Compared to other less elegant solutions, memory and stack overhead is truly minimal.

### Hardware Support

Each code bank is selected via additional address lines. The actual bank address is then generated by the bank switch code. These routines are provided in both object and source form.

The functioning of the bank switch logic is controlled by external hardware, and is configured by the user in a file provided for that purpose. In this manner all forms of bank selection logic and hardware are conveniently and easily accommodated.

BL51 is completely compatible in function and invocation with L51. No re-compilation or re-assembly is ever necessary. All existing C51, A51, and even Intel ASM51 and PL/M-51 modules are easily accommodated by BL51.

### Generating Individual Modules

OC51, a BL51 support program is included. The purpose of OC51 is to generate individual code bank modules for your PROM burner from the banked composite object created by the BL51 processing pass.

### RTX51

BL51 is also used to build and manage the TCB's (Task Control Blocks) required by both RTX51 Tiny and RTX51 Professional. BL51 is included in both kits.

## RTX51—Real Time Operating Systems

- ▲ Supports all members of the MCS® 51 microcontroller family
- ▲ Dynamic memory management functions for fast effective usage of precious CPU resources
- ▲ Supports both round-robin and pre-emptive task switching for up to 256 tasks, with up to 19 active at the same time
- ▲ Both BITBUS and CAN interfaces are included in the RTX51 Professional delivery
- ▲ Use of advanced compiler features reduces code size and increases execution speed
- ▲ Efficient & flexible scheduling of tasks using pre-emptive or round-robin scheduling
- ▲ Up to four scheduling priorities work in parallel with interrupt functions

### Contact Information

Franklin Software, Inc.  
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 San Jose, CA 95129  
 Tel: (408) 296-8051  
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 Info: (408) 296-8056 (fax back)  
 BBS: (408) 296-8060

- ▲ System and Task consistency checks and all memory allocation functions are performed by the BL51 linker/locator
- ▲ Both versions of RTX51 (RTX51 and RTX51 Tiny) are fully integrated into the Franklin C51 software development environment
- ▲ The TASK and PRIORITY declarators are an integral part of the C51 compilers language semantics
- ▲ RTX51 Tiny is the smallest, fastest, most complete RTOS available for the 8051
- ▲ Easy to use! Integration with the C51 compiler eliminates the need to write assembler statements
- ▲ Easy to debug and simulate with dScope-51 our high level language oriented, symbolic debugger/simulator

### Product Information

RTX51 is a powerful dedicated multitasking Real-Time Operating System (RTOS) executive designed expressly for the 8051 family of microcontrollers. Use of a system executive like RTX51 simplifies system design, software programming, and debugging of complex applications which require fast reaction time to critical events. RTX51 is an efficient and effective way to manage multiple jobs (tasks) on a single CPU. RTX51 is available in 2 versions:

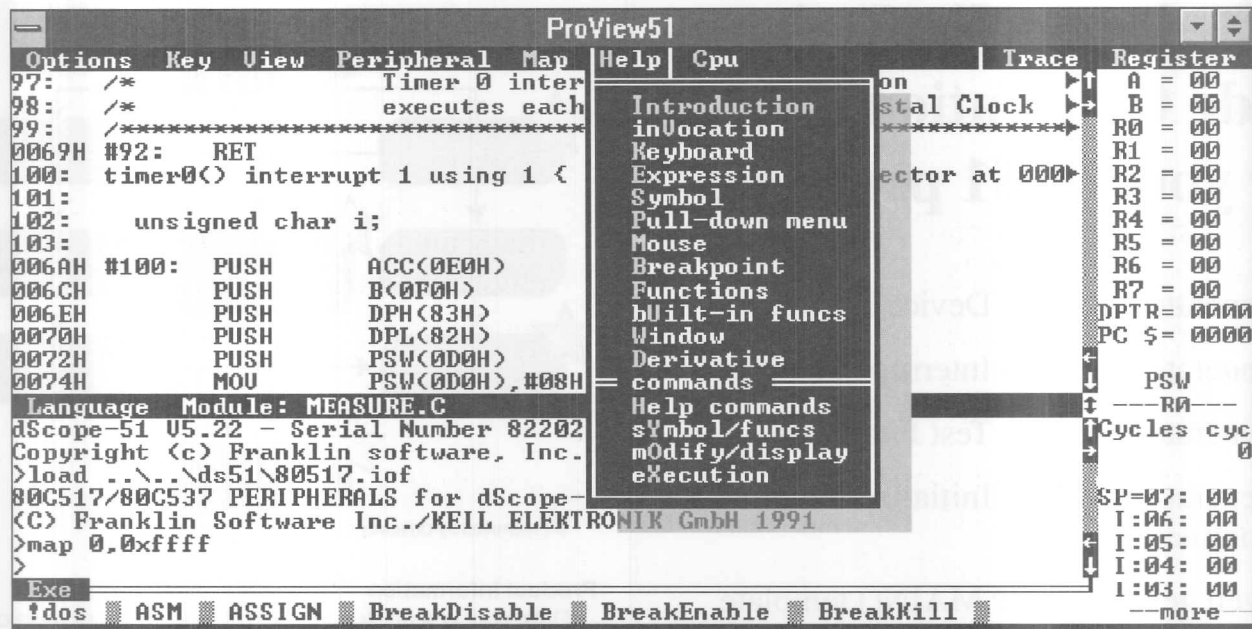
**RTX51** is a full featured RTOS for the 8051 capable of both round-robin and preemptive task switching. Designers can define up to 256 tasks, with up to 19 active at the same time. Up to four scheduling priorities can be assigned and still work completely integrated and in parallel with interrupt functions.

**RTX51 Tiny** is an abbreviated version of RTX51 supporting round-robin task scheduling. Requiring less than 600 bytes of CODE space, it runs exceptionally well on single chip 8051's and has no explicit requirement for XDATA memory. RTX51 can execute up to 16 tasks. All CODE developed under RTX51 Tiny is completely compatible and usable by RTX51 Professional.





## DS51 Source Level Debugger/Simulator



- ▲ Window oriented user interface displays:
  - Command input & output
  - High level language display, or mixed with comments, assembler mnemonics, and trace buffer
  - View/Modify all CPU registers and memory areas
  - Watch variables
  - Serial Communications
- ▲ Full debug information with object types
- ▲ High-speed simulation engine
- ▲ A reconfigurable target monitor suitable for all versions and derivatives of the 8051 is included
- ▲ Simple command entry with:
  - Mouse
  - Command Line
  - Pull-down menus
  - Function & cursor keys
- ▲ Extensive break capabilities
- ▲ Includes an interface to Hitex, Intel, and Nohau in-circuit emulators

## Product Information

dScope-51 is a source level debugger for Franklin's C51 and A51, and Intel's PL/M-51. dScope-51 is both a powerful simulator and target debugger. The complete package includes the DS51 debugger/simulator, a reconfigurable target monitor, and TS51 — our powerful DS51-like interface to the monitor, and Hitex, Intel, and Nohau in-circuit emulators.

DS51 can simulate the whole 8051 CPU including the peripherals of most 8051 derivatives available today. A 'C'—like macro language adds the capability to simulate a wide variety of complex input signals or external I/O functions.

The MON51 target monitor considerably expands the capability of dScope-51 with its direct interface to your target hardware.

Our TS51 (Target Scope) interface presents the same screen, and most of the same capabilities of DS51 to the user. But instead of running the simulation engine, TS51 can interface via the serial port to your target monitor, or to your Hitex, Intel, or Nohau in-circuit emulators, eliminating the need to learn yet another new software program.

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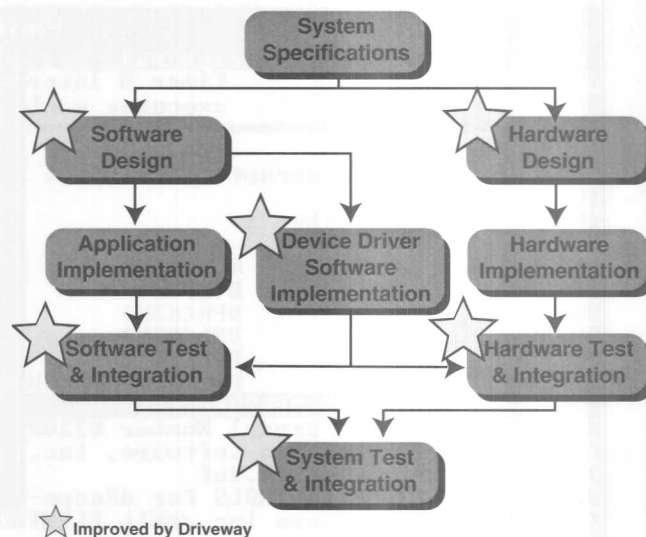
## 8051-DriveWay™

# 8051-DriveWay™; A Code Generation Tool for your 8051 projects!

- ▲ Generate complete Device Drivers
- ▲ Generate complete Interrupt Routines
- ▲ Generate complete Test Functions
- ▲ Generate complete Initialization Routines
- ▲ Even generate your MAIN() template
- ▲ Cut your "time-to-market" from months to days
- ▲ Never have to read a chip manual again
- ▲ Improve system reliability
- ▲ Spend your nights sleeping, rather than searching for a bit that was not handled correctly
- ▲ Improve your product development cycle while you develop consistent reliable code

## Contact Information

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## Product Information

DriveWay is a quick and dependable means of developing device drivers. It is an easy-to-use Windows™-based application that generates "C" source level code for peripheral chip device drivers.

For each on-chip peripheral, DriveWay can produce a set of functions to control that peripheral. Your application can then call these functions to control the required hardware.

The typical embedded system development process is shown above. The ☆ symbol indicates those functions of your development cycle that can benefit dramatically from the application of DriveWay's knowledge base.

DriveWay generates C language source code. This ensures fast and easy integration of your peripheral devices into your designs. DriveWay design rules place particular emphasis on achieving a clear, structured style and form, in the C code that it generates. This promotes fast, simple updates as the code grows and matures.

## Advantages

Your time is valuable. Before you begin your next project, ask yourself, how many hours did you spend reading how many data sheets before you wrote your first line of code? Did the code work right away?

How many hours did you waste searching for some bit that wasn't handled properly? How much time did you spend searching for a software bug, when improper use of the hardware was to blame? How much effort have you wasted debugging hardware using software that never actually worked?

Now you can put DriveWay to work for you. Make the advantage yours!

# MCS<sup>®</sup> 51/251 Microcontroller Development Tools

## MCS<sup>®</sup> 51 and MCS<sup>®</sup> 251 Microcontroller Software Development Tool Suites

- ▲ Modern modular "Building Blocks" approach lets you choose just those tools you need to do your job
- ▲ Common, consistent, familiar, performance oriented interface
- ▲ Easily upgrade or increment your tools as your needs or the demands of your project increase
- ▲ Enables the professional embedded systems developer to easily switch microcontrollers to accommodate the most demanding projects
- ▲ Each kit or suite of tools is a complete product, ready for immediate use, backed by a full year of our top-notch product support
- ▲ Completely supported by all major emulator vendors
- ▲ This is the software recommended by all 8051 chip vendors and tool suppliers

### Contact Information

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**Franklin Software, Inc.** was formed in the late 1980's to provide the first truly useful cross development tools for the 8051 embedded systems market. Our premise was simple, and apparently in this industry unique: Provide powerful, high quality, high-performance, effective, easy-to-use development tools to the embedded controller marketplace.

**Microcontroller Development Tools:** Franklin supports application development for the 8051, MCS<sup>®</sup>51, and MCS<sup>®</sup>251 family of microcontrollers with a powerful set of development languages, debugging tools, multitasking Real-Time Operating Systems and utilities. All tools run on any standard PC system and guarantee an easy, efficient and reliable way to create programs for each of these microcontrollers and all of their derivatives.

**MCS<sup>®</sup>51 Architecture:** The Intel 8051 has been in widespread service since the early 1980's. Complete with a wide variety of outstanding features and peripherals, the 8051 CPU core is destined to see service well into the 21st century. More than 200 different 8051 derivatives and variations are available today from a variety of chip vendors.

More than half of all embedded microcontroller projects use members of the 8051 microcontroller family. As an embedded processor, it has no equal, especially given its wide acceptance and remarkable ability to adapt to new and ever changing peripheral needs.

A typical 8051 family member contains the 8051 CPU core, data memory, code memory and some versatile peripheral functions all on a single chip. A flexible memory interface allows expansion of the capabilities of these devices with standard microprocessor peripherals and memory devices.

**The MCS<sup>®</sup>251 Architecture:** In response to demands for more power and capability, Intel has developed a powerful new 8/16-bit microcontroller: the MCS<sup>®</sup>251 microcontroller.

### Highlights of the 251 CPU core

- powerful 8-, 16-, and 32-bit instructions
- flexible 8-, 16-, and 32-bit registers
- fully linear 16MB address space
- direct support for 16- & 32-bit pointers
- 16-bit stack and stack addressing capability
- very fast 64KB direct addressing mode
- completely 8051 code compatible
- compact, RISC-like, instruction set

A pin-for-pin replacement for the 80C51FX, the 251 is completely 8051 execution and object code compatible, and will execute all of your existing 8051 code up to 5 times faster. Existing 8051 applications recompiled with the new Franklin C251 C compiler are up to 15 times faster.

(Continued)

# MCS® 51/251 Microcontrollers

(Continued)

**Why Use Franklin Development Tools?** Franklin has become synonymous with quality embedded development tools, outstanding support, and continuous update and refinement of existing tools. We're constantly striving to improve every aspect of our tools' performance. From superior code generation, integrated development environments, newer and vastly improved manuals, the addition of PC-lint, to the endless task of adding new capabilities to meet the express demands of newer and faster chips. This benefits you directly! Franklin tools will always be on the cutting edge of code generation technology and overall product quality. We've made our name with this, and we don't intend to change our ways!

**A look through** any of the relevant trade publications will quickly reveal that there is no shortage of vendors willing to sell you a plethora of software "odds-and-ends" portrayed as 8051 software development tools. Only Franklin Software is committed to bringing you the best development tools your money can buy. Often users site price as the main reason affecting their selection. In all cases, you will always get what you pay for.

**Only Franklin Software** has the experience and development expertise to bring you complete ready-to-go development software for your 8051 and 80251 projects. While most of our tools are available separately, we've taken the extra step of bundling them into four carefully selected "suites". Each suite is complete and able to generate high quality software with a minimum of delay.

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There may be up to several hundred files in each delivery. By grouping individual products into functional groups for you, we provide the professional user with an arsenal of development tool capability and prices. To meet the overall needs of the professional embedded software developer, we carry four primary development suites:

**A51:** Our fully Intel ASM-51 source compatible macro assembler kit. A51 includes our powerful PV51 integrated developers environment.

**C51:** Our ANSI compliant C51 compiler kit. With full math, string, and transcendental libraries complete with sources to all I/O and start-up functions. This kit includes the A51 assembler kit described previously, and adds PC-lint, a powerful C language syntax and semantic checker to the basic C51 compiler product.

**DK51:** Our best value. This complete developer's package adds our high-performance dScope-51 (DS51) debugger/simulator, the powerful new tScope-51 (TS51) target debugger, and our reconfigurable MONITOR-51 with startup and I/O sources; to the C51 kit described above. New in mid-1994; for students, experimenters, hobbyists, and novice users; we're offering two DK51 Lite versions with some size and capability restrictions. DK51 Lite will execute up to 8Kbytes of 8052 code in the SMALL memory model.

**PK51:** The true professionals choice. This complete package adds our 2 megabyte CODE banking linker, and our powerful RTX51 Tiny Real-Time executive kernel to the DK51 kit described above. With PK51 no project is too large, or too complex.

We've designed each kit to completely subsume the previous kit. This permits the frugal embedded systems developer to purchase a kit expressly tailored to his or her specific needs. If and when it becomes necessary to upgrade for more capability, the only charge is the difference in cost.

In addition to the complete kits described above, we also carry:

**RTX51 Professional**, a sophisticated full featured Real-Time Operating System (a completely compatible super-set of RTX51 Tiny) for the 8051. RTX51 Professional comes complete with both BITBUS and CAN controller interfaces.

**DriveWay - 8051**; a powerful new Windows™- based source CODE generation tool designed to speed and ease your introduction into the 8051 working environment by eliminating the tedium of having to learn and implement the "fine print" in each of the various chip vendor manuals.

Using just your mouse, DriveWay will select and generate all of your driver code, interrupts, and main() routine complete with diagnostics, test code, and documentation for a wide variety of chips!

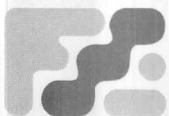


## ProView—Turbo Tools for your 8051 C projects!

- ▲ Complete turbo development capabilities designed expressly for the best 8051 development tools (our very own, of course) available today
- ▲ ProView features a window oriented user interface with configurable full function editor, program and object file management, pull down menus, dialog boxes, and a comprehensive tools menu
- ▲ Full screen, multiple file, interactive turbo edit capability for both source and object files
- ▲ Easy access to the Editor, Tools, Projects, and Targets via fast efficient pull-down menus
- ▲ Instant "Hot Key" switching between ASCII text or hex object code, manage and scan an error list keyed directly to the source line in question
- ▲ Complete project management automates the compilation and production of your code modules

### Contact Information

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**FRANKLIN  
SOFTWARE, INC**

## ProView—Turbo Tools

- ▲ Easily navigate through multiple display windows, with full user control of colors, sizing, and complete access to all files and tools
- ▲ Fully supports all Franklin Software tools, and our ProROM 64 ROM socket emulator

### Product Information

Our all new ProView provides a powerful "turbo C"-like environment for the industries most powerful 8051 development tools. ProView enhances your Franklin 8051 development software with a familiar turbo C-like user interface and mouse controls.

Use your mouse to access pull-down menus and pop-up dialog boxes. These provide a simple direct means to control both the development process and view the results. At the heart of ProView is a powerful configurable new editor. This editor is intimately coupled to Franklin's 8051 development tools to manage all aspects of error free target code production.

ProView's configurable windowed environment is instantly familiar to C programmers familiar with "Turbo C". The "Brief"-like editor uses smoothly integrated windows and pull-down menus to link our 8051 C compiler and libraries, A51 macro assembler, DS51 high level language debugger/simulator, L51 and BL51 linkers, and TS51 target monitor in a fast, sophisticated, configurable, yet easy-to-use mouse oriented graphical environment.

### Project

ProView organizes 8051 development activities and resources around the concept of a "Project". A Project lists each source file (C, PL/M, or assembler), associated objects, and loadable target files in a Project file. ProView tracks include files, and manages and automates the entire software production process. Each modified file is verified and either compiled or assembled as required, and re-linked into a new load module.

ProView also directly supports and interfaces with our high-speed 64K ROM emulator (available separately). This permits direct modification, translation, linking, and downloading with optional execution of your code.

Professional products, providing professional solutions, for the professional user!

(continued)

## ProView—Put “Pizzazz” into your projects!

- ▲ Turbo development capabilities speed your 8051 products to market
- ▲ Automated “Project” control minimizes version control housekeeping
- ▲ Windows-like interface integrates 8051 hardware and software development tools
- ▲ Efficient symbolic user interface does not require MS Windows™ to operate
- ▲ As with all Franklin tools, ProView is simple and easy to install and use
- ▲ A modern, robust windowing system, for DOS, ProView smoothly and completely integrates all existing Franklin tools

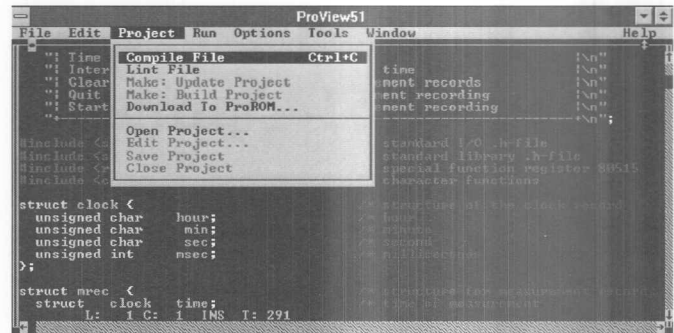
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## ProView—Turbo Tools

(continued)



*ProView provides a familiar pull-down menu bar. Users of “Turbo C” and Microsoft’s “PWB” will feel right at home.*

### Product Information

ProView requires Franklin C51 compiler V3.20, and DS51 debugger/simulator V5.01, or higher. ProView completely integrates all Franklin 8051 tools, including: The C51 compiler, DS51 debugger/simulator, A51 macro assembler, L51 and BL51 linker/locators, Lib51 library manager, and other utilities.

Special Pop-Up dialog boxes enable the user to configure and define a wide variety of operational parameters. ProView is completely transparent to all supported hardware and software tools. Contact us to inquire about availability of support for additional vendors’ 8051 hardware and software tools.

ProView runs on all IBM compatible PC/AT’s running MS or PC-DOS 3.0 and up, with a 286/386/486 or higher processor and at least 512 Kbytes of RAM. An EGA or VGA graphics controller and display are also required. ProView is completely compatible, and will work well with all software tools from Keil Elektronik GmbH.

ProView (PV51), with complete documentation, is available for immediate delivery. Request Franklin part number 3070. Delivery consists of a manual and a 1.44MB DOS diskette.

### Specifications and Requirements

#### Hardware

IBM PC-AT or compatible  
 DOS 3.0 or higher  
 512K Bytes of RAM  
 EGA or VGA graphics adapter  
 Hard disk drive with at least 2 megabytes available

#### Software

C51 V3.20 (Release V) and up is required  
 DS51 V5.01 (Release V) and up is recommended

### Do You Need More Information?

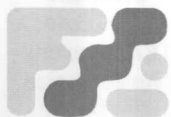
If you have a touch-tone phone and a fax machine, you can call Franklin’s 24 hour information HOTLINE at: (408) 296-8056. Select documents #1001 and #1020.

## A51—Macro Assembler Kit

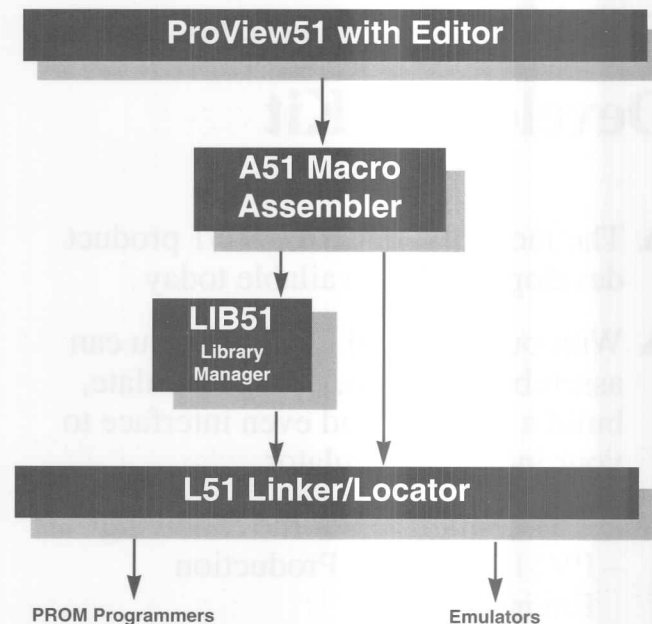
- ▲ As with all Franklin 8051 tools, the assembler output is Intel OMF-51 object module compatible
- ▲ Fully Intel ASM-51 code and macro language compatible
- ▲ Delivered with ProView-51 Integrated Developers Environment
- ▲ Accommodates the Motorola macro language too, making ports from other less capable microcontrollers quick, simple, and easy
- ▲ Includes L51 linker/locator
- ▲ Includes Lib51 library manager to allow building and maintenance of fast efficient libraries
- ▲ Includes OH51 to permit quick and easy absolute file to Intel HEX conversion for loading into in-circuit emulators and PROM burners
- ▲ Delivered complete with include (\*.INC) files for most popular microcontrollers available today

### Contact Information

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**FRANKLIN  
SOFTWARE, INC**



### Product Information

Franklin's **A51** macro assembler is the latest version in our solid line of basic 8051 and 80251 programming tools. A51 even translates your Intel ASM-51 source files. As with all Franklin 8051 and 80251 tools, A51 emits an Intel OMF-51 object module.

A51 is delivered with ProView-51, our Integrated Development Environment. **PV51** features a reconfigurable "Brief"-like editor and project wide build or make facility.

The **L51** linker/locator links or binds A51, ASM-51, C51, and PL/M-51 modules into a single executable module. Detailed program flow analysis, the ability to expressly locate elements of all kinds at any location, and advanced listing and reporting features are an intrinsic part of this important and necessary tool.

The **Lib51** library manager is provided to generate specifically formatted, easily accessed, cataloged, indexed, and ordered libraries of code modules.

Finally, the **OH51**, Object module to Intel HEX file converter, is provided to complete the code generation process by generating files suitable to loading into most emulators and PROM burners.

### Scope of Delivery

As with all Franklin products, this product delivery is complete and ready to use. The following individual products comprise the A51 delivery:

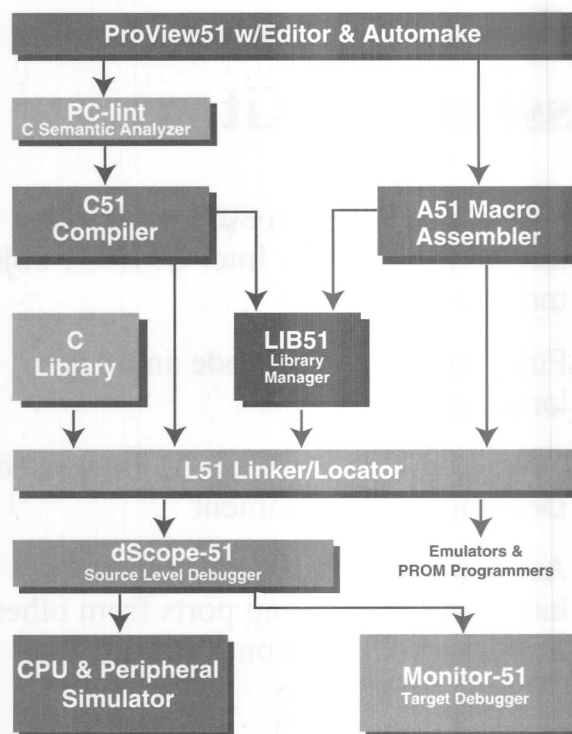
- A51; High performance macro assembler.
- L51; High performance overlaying linker/locator.
- Lib51; Library manager.
- OH51; Object to Intel HEX file converter.
- PV51; Integrated Development Environment.

## DK51—Complete 8051 Developers Kit

- ▲ The most cost effective 8051 product development kit available today
- ▲ With our powerful DK51 kit you can assemble, compile, debug, simulate, build a monitor, and even interface to your in-circuit emulator
- ▲ DK51 contains all of the following:
  - PV51 Integrated Production Environment
  - A51 Macro Assembler suite
  - C51 Compiler suite (with PC-lint)
  - DS51 Debugger/Simulator suite
- ▲ DK51 is also available in two “Lite” versions for students and hobbyists
  - CASPER has an 8K maximum code size limit (inclusive of library code)
  - EINSTEIN has a 1K maximum code size limit (exclusive of library code)

### Contact Information

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To meet the overall needs of the professional embedded software developer, we carry 4 primary development suites: The A51 Macro assembler suite, the C51 'C' language compiler suite, the DK51 developers suite, and the PK51 Professional developers suite.

By grouping individual products into functional groups for you, we provide the conscientious user with a range of development tool capability and prices.

### Product Information

DK51 represents our best value for the cost conscious 8051 product developer. The DK51 package adds our powerful DS51 debugger/simulator to the C51 compiler suite. By adding this powerful tool set, the developer is able to assemble, compile, debug, and simulate his or her project. All aspects of complete project development are bundled into these cost effective kits.

We've developed two new *Lite* versions to enable students, hobbyists, and those with projects that don't require the full power of our tools to still use the best tools available today for the 8051 microcontroller.

The *Lite* kits are explicitly designed to generate small memory model code for the 8052 microcontroller. Both kits contain full math libraries with floating point. We've limited the final code size a bit, and taken out the A51 macro assembler, the Lib51 librarian, the compact and large memory models, and support for controllers other than the 8052. **CASPER** version, designed for the hobbyist, has an overall 8K Byte code size limit — including library code. **EINSTEIN** version, designed for the student or novice, has a 1K Byte code size limit exclusive of library code.

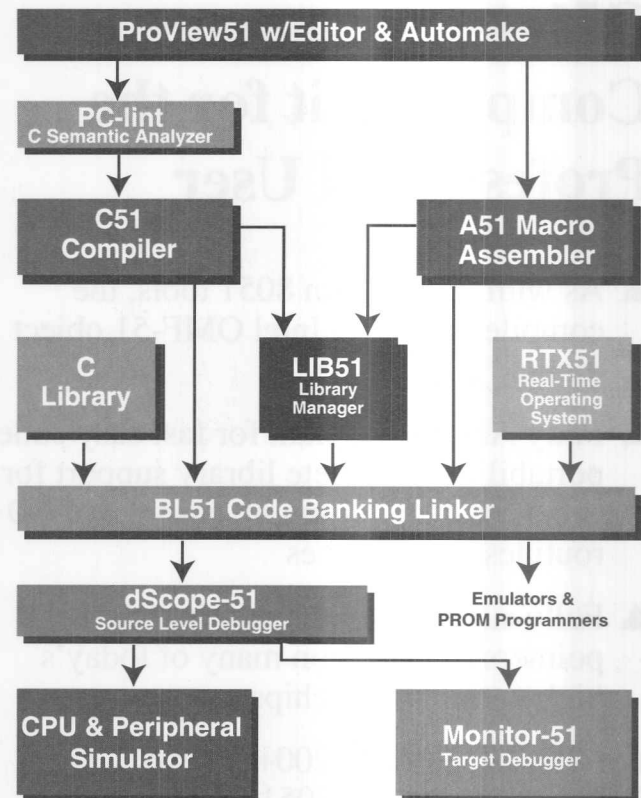


## PK51—The Professional 8051 Developers Kit

- ▲ Designed expressly for the Professional user who demands, and can afford, the best tools available
- ▲ When quality matters, and when the tools you use are the foundation for your business or its survival, then only the best will do
- ▲ PK51 contains all of the following:
  - PV51; Integrated Developers Environment
  - A51; Macro Assembler suite
  - C51; Compiler suite (with PC-lint)
  - DS51; Debugger/Simulator suite
  - BL51; 2 megabyte code banking linker
  - RTX51 Tiny; complete with sources
- ▲ One full year of technical support

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By grouping individual products into functional groups for you, we provide the conscientious user with a range of development tool capability and prices.

### Product Information

For 1995 the PK51 developers kit has been refined to meet the exacting needs of the professional embedded systems development engineer. It is a complete software development package and contains all the tools necessary to effect efficient and reliable software design: C Compiler, Macro Assembler, Linker & utilities for code banking, multi-tasking Real-Time Operating System, and a powerful source level debugger complete with simulator, Monitor, and Emulator interfaces.

PK51 represents our best product package. PK51 was expressly designed to meet the needs of the professional embedded systems developer. The PK51 package adds both BL51 and our fast RTX51 Tiny Real-Time Executive to the basic DK51 developers kit described previously.

With BL51 and RTX51 Tiny, the professional user can address all aspects of 8051 product development.

## C51—C Language Compiler Kit for the Professional User

- ▲ As with all Franklin 8051 tools, the compiler output is Intel OMF-51 object module compatible
- ▲ Fully ANSI compliant for fast easy code portability. Complete library support for full math, floating-point, string, and I/O routines with sources
- ▲ Fully supports all the multiple data pointers available on many of today's high performance chips
- ▲ Fully supports all 200+ known derivatives of the 8051 family
- ▲ Individually definable REENTRANT and INTERRUPT functions
- ▲ The basic "*must have*" product for today's complex and time critical designs. Recommended by all major 8051 chip vendors

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### Product Information

C is a high level programming language which combines structured programming, versatile data structures, code efficiency, and a wide variety of mathematical, logical and string operations. As a language, C is not dedicated to specific applications. However, many applications can be dealt with more easily and much more efficiently than with other more specialized languages.

The availability of C for many common microcontrollers, allows the use of generic C code in many different applications with little or no modification.

### C51 features

C51 is ANSI compliant complete with all standard, string, math, and transcendental library functions. C51 includes sources for all library input, output, and startup routines. C51 fully supports all members of the 8051 family and all derivatives without regard to vendor.

C51 supports chips with multiple data pointers, multiple serial ports, arithmetic co-processors, A to D converters and other "special" peripherals. C51 easily and completely accommodates the restricted/enhanced/alterd capabilities of all 8051 derivatives.

C51 also includes a Franklin configured version of Gimpel Software's PC-lint. The compiler kit is complete in every way as delivered and is ready to make executable code.

The C51 package contains: The C compiler and all libraries and includes as described above. In addition, it also includes the entire A51 Macro assembler package itemized previously and examples and other illustrative code.

If you have to write code; make it fast, make it tight, make it right. Make it with C51!

### Scope of Delivery

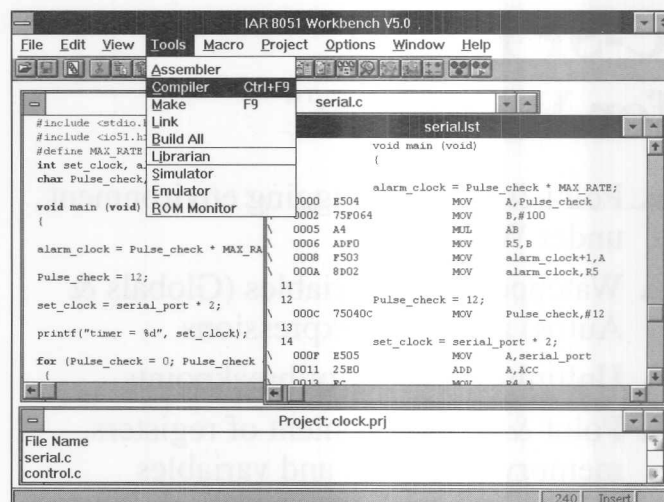
- C51 compiler & all libraries.
- ProView51; Integrated Development Environment with high performance multiple file editor.
- PC-Lint; C language semantic analyzer.
- A51; The complete Intel ASM-51 compliant high performance macro assembler kit described previously.
- L51; High performance overlay Linker/Locator.
- Lib51; Library Manager for the creation of code libraries.
- OH51; An 8051 executable object module to Intel Hex file converter.

## 8051 Compiler

# 8051 Embedded Workbench for Windows™

- ▲ Fully integrated development environment under Windows (DOS version still supported)
- ▲ ANSI standard C Compiler
- ▲ Extended Keywords specific for 8051
- ▲ Built-in advanced chip-specific optimizer generating highly compact code
- ▲ Multiple memory models supporting single-chip to banked designs with up to 8MB of code
- ▲ Individually definable REENTRANT or STATIC functions
- ▲ Memory specific pointers
- ▲ Dynamic register variables and efficient use of parameter passing via registers
- ▲ Nine levels of each Code or speed optimizations
- ▲ Support for 10 data types and up to 32768 external references
- ▲ Extended C library (100+ functions) with optimized floating point
- ▲ Easy & fast interrupt handling directly in C
- ▲ Generates mixed C & assembly listings from the compiler & fully comprehensive cross reference map file after linkage
- ▲ Supports all 8051 derivatives

**Contact Information**  
 USA & Canada  
 IAR Systems Software, Inc.  
 One Maritime Plaza  
 San Francisco, CA 94111  
 Tel: (415) 765-5500  
 Fax: (415) 765-5503



## IAR 8051 Embedded Workbench

IAR's 8051 kit comes with IAR's optimized C compiler V5.0, C-SPY Windows debugger, relocatable macro-assembler, universal linker XLINK, librarian XLIB, Tiny Kernel, and a Windows editor & user interface.

### IAR optimized C Compiler

The IAR 8051 compiler contains an advanced chip-specific optimizer with extensions adapted both to the 8051 architecture and to embedded C programming.

### Macro-Assembler

The IAR 8051 package comes with a relocatable macroassembler for time-critical routines. Interfacing between C and assembly is straight forward. It allows you to use relocatable as well as absolute code segments.

### Linker and Librarian

The linker XLINK supports complete linking, relocation and format generation to produce PROMable code. XLINK generates over 32 different formats and is compatible with most popular emulators. The librarian XLIB allows you to create and maintain relocatable libraries that get loaded only if they're called.

### Windows Editor and User Interface

A full featured Windows editor and a very friendly point and click Windows user interface are at the heart of the IAR 8051 Workbench. You will be able to go through all of your development cycle without leaving the Workbench and Windows. (DOS version still supported).

### Hosts Systems Supported

IBM PC & compatible (386 or above); SUN 4 (SPARC); HP 9000 series 700.

## C-SPY 8051

# C-SPY 8051 for Windows™

- ▲ Point & Click debugging environment under Windows™
- ▲ Watchpoints on variables (Globals & Autos) as well as expressions
- ▲ Unlimited number of breakpoints
- ▲ Point & modify content of registers, memory locations, and variables
- ▲ Debugging on C and assembler levels
- ▲ Function call list (with parameter) and function trace
- ▲ Command and log file control
- ▲ C-like macro language to simulate I/O's and interrupts
- ▲ Powerful yet easy-to-use command set
- ▲ Supports debugging of banked code

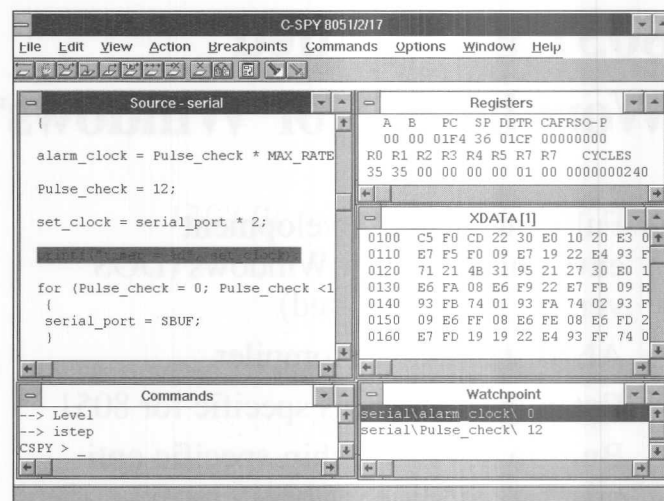
## Contact Information

USA & Canada  
IAR Systems Software, Inc.  
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IAR Systems AB  
P.O. Box 23051  
S-750 23 Uppsala  
Tel: +46 18 16 78 00  
Fax: +46 18 16 78 38

Germany  
Tel: +49 89 470 6022  
Fax: +49 89 470 9565



## Product Information

C-SPY 8051 is a very powerful debugger available as part of the IAR Embedded Workbench for the Intel MCS®51 microcontroller, or as a separate product. It has a true Windows™ interface, with windows for the source code, registers, watchpoints, memory space, terminal I/O emulation and command input. With a point and click interface, C-SPY provides you a 'Plug & Play' environment while executing powerful debugging commands.

C-SPY is designed to help you speed up your troubleshooting time and quickly zoom in on the problem areas in your code.

## Registers & Memory

A register window allows you to monitor or point & modify the content of the 8051 registers during code execution. And a memory window allows you to display or change the content of your RAM space. Also used to display ROM space and monitor Stack manipulations.

## Watchpoint & Terminal I/O

You can put watchpoints on any global or auto variable. You can also display content of arrays, structures, and pointers. A terminal I/O window displays your outputs on screen and accepts inputs from the keyboard.

## Commands

A powerful yet easy-to-use command set; includes all what you need in a debugging environment. Frequently used commands are invoked through PF keys.

## C-SPY/Monitor

C-SPY is also available as a ROM-Monitor version. The monitor is user configurable and could be used with any board fulfilling the basic requirements of the ROM-Monitor.

## C-SPY Emulator version

C-SPY could also be connected to an emulator. This way you get all the C-SPY features and ease-of-use while running in real-time emulation mode. (Please call and ask for the latest list of supported emulators).

## Hosts Systems Supported

IBM PC & compatible (386 or above), SUN 4 (SPARC); HP 9000 series 700.





# MICRO/C-51™

## 8051 C Compiler Kit

- ▲ Unrestricted variable placement. Place ANY variable in ANY memory map
- ▲ Direct "C" access to all on-chip devices (SFRs) by name
- ▲ Power-up your Boolean processor with support for bit variables and SFRs
- ▲ Drive ANY "C" function from ANY interrupt source
- ▲ Kit includes MICRO/C-51 Compiler, MICRO/ASM-51 Relocatable Macro Assembler, linker, librarian, and user's guide loaded with examples
- ▲ Use our C library to perform standard operations. Full source code included
- ▲ Add our optional MICRO/SLD-51 Simulator/Source Language Debugger. Debug in C or assembly
- ▲ Helpful technical support. Call for our software tools catalog with complete technical details and a FREE DEMO DISK

### Contact Information

Micro Computer Control Corporation  
P.O. Box 275/17 Model Ave.  
Hopewell, NJ 08525 USA  
Tel: (609) 466-1751  
Fax: (609) 466-4116  
CompuServe ID: 73062,3336

**Micro Computer Control**  
*Software Development Tools*

/\* hello.c MICRO/C-51 Sample Program \*/

```
#define T1M1    0x20    /* Timer 1 Mode */
#define SMOD    0x80    /* Serial Mode Doubling */
#define BAUD    0xfd    /* 19.2K baud @11.059 Mhz */
```

```
main()
{
    /* Initialize Serial Port */

    sm1 = 1;          /* 8-bit UART */
    tmod = T1M1;      /* Timer1 8-bit Auto-Reload */
    tl1 = th1 = BAUD; /* Set Baud Rate */
    pcon = SMOD;      /* Double Baud Rate */
    tr1 = 1;          /* Start Timer1 */
    ti = 1;            /* Make Tx Ready */

    while (1) /* loop forever */
    {
        printf("Hello, world/n");
    }
}
```

### Product Information

Is your latest project falling behind schedule? Need programming speed and flexibility? Put a real power boost to your development efforts, move up to MICRO/C-51, our "C"-like Cross-Compiler for 8051 embedded controller applications.

MICRO/C-51 supports 8051 derivative chips from Intel. And it's user-configurable to support even the newest chips as they become available.

Would you like to prototype a system in hours, or add interrupt code in minutes? MICRO/C-51 gives you the speed and ease of programming in "C", while giving you complete control of your micro's hardware.

Need help tracking down bugs? Try our optional MICRO/SLD-51 Simulator/Source-Language Debugger. It provides a complete target system debugging environment right on your PC, no additional hardware required.

### System Requirements

- IBM PC or compatible
- Single diskette+
- DOS 2.1+

### Chips Supported

Intel 8051-based microcontrollers that execute all 8051 instructions. NMOS, CMOS, OTP, ROM, ROMless, and internal or external RAM-based systems.

IDE Control Panel

Background Processing

Source-Level Debugger

Easy Tool Configuration

On-Line Manuals

Visual Debugging

Simulator & ICE Support

## The World's Hottest Windows™ Hosted 8051 IDE

PLC's COMPASS/51™ Integrated Development Environment for the 8051 family microcontroller is the hottest Windows hosted embedded software development system available. It offers a comprehensive toolset that includes an ANSI C Cross Compiler, Macro Assembler, Linker/Locator, Object Librarian, and Source-level Debugger. Because you can design, code, and test your software without leaving Windows™, you'll want to kiss your DOS window good-bye.

### True Windows Interface Increases Productivity

COMPASS/51 has a true Microsoft® Windows user interface that dramatically increases your productivity. The COMPASS/51 IDE efficiently manages your projects and allows you to compile, assemble, and link your programs in background mode, thus you can turn waiting time into productive time. Advanced Program Visualization capabilities provide you with a graphical representation of your application at both modular and functional levels.

## ANSI C Compiler Optimizes for Speed or Size

The COMPASS/51 ANSI C Compiler lets you optimize your code for speed or size, allowing you to squeeze the maximum performance out of the CPU. Microsoft and Borland™ compatibility allows you to prototype your algorithms using familiar tools early in your product's life cycle.

### Powerful Debugger and Simulator Make Finding Bugs a Cinch

The COMPASS/51 Debugger lets you debug your assembly and/or C code at the source level using an advanced feature set and visual debugging techniques. Popular emulators are supported without sacrificing features of the integrated environment. The COMPASS/51 Instruction Simulator also interfaces seamlessly to the COMPASS/51 Debugger, allowing you to completely develop your application while waiting for hardware to be developed.

### Contact Information

Production Languages Corporation  
P.O. Box 109  
Weatherford, TX 76086  
Tel: (800) 525-6289  
Tel: (817) 599-8363  
Fax: (817) 599-5098



# STIMGATE®

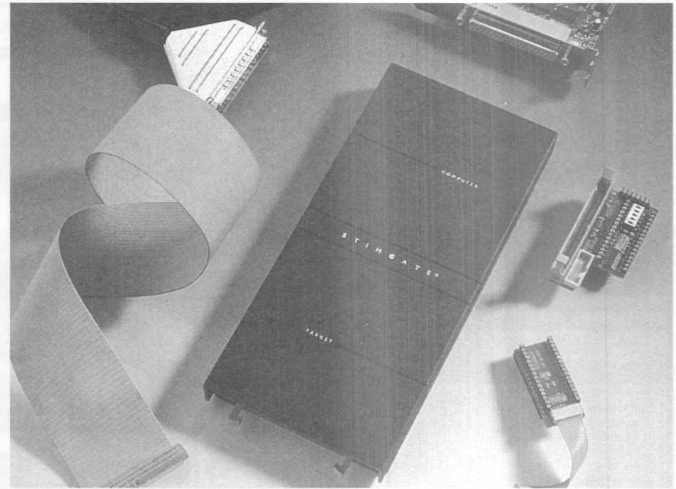
## Target Controller for ANSI-C

- ▲ Universal C development platform for embedded processors
- ▲ Uses Borland-C or Microsoft-C as debugger frontend
- ▲ Debug your target application in real-time on the PC. I/O and interrupt operations use the real target processor hardware
- ▲ Dynamic debugging with test messages on the PC screen from target programs
- ▲ 128K to 1M bytes download memory
- ▲ Stimuli-Gateway functions complete ANSI-C with a "standardization" of simple I/O and interrupt operations
- ▲ Supports all the most popular CPU families with 8- or 16-bit external databus
- ▲ Supports all present and future processor derivatives in a CPU family

### Contact Information

Your local STIMGATE sales office or distributor or  
 RAMTEX A/S  
 Box 84, DK-2850 Naerum  
 Denmark  
 Tel: +45 4550 5357  
 Fax: +45 4550 5390

RAMTEX®  
 A/S



### Product Information

The STIMGATE Target Controller is a totally new kind of development tool, which allows the C programmer to use the existing Borland C/C++ or Microsoft C/C++ PC platforms directly for development and test of C programs for most embedded processors. The STIMGATE solution provides the C programmer with a more productive and more flexible alternative to the existing in-circuit emulator concept.

**The Target Controller** connects the embedded target processor system to the PC, in such a way that the embedded C program can be executed real-time in the PC while all the basic I/O and interrupt operations in the source code still work with the real target processor hardware. Debugging and test is done with the well-known and highly-productive PC tools. All features in Integrated Environment can be used without limitations.

**The C source code is made portable** between the PC and target compilers, by using the enclosed Stimuli-Gateway functions. These few functions complete ANSI-C with a "standardization" of simple I/O and interrupt operations. They generate no machine code overhead when compiled for the target processor.

**The Stream Windows functions library** provides the C programmer with standard outputs for test messages from embedded applications. With ANSI-like stream functions test messages can be written to individual windows on the PC screen, even from interrupt functions. These efficient and easy-to-use stream functions are fully portable between PC and target. When executing in target, test messages are sent to the PC screen via the Target Controller probe.

**The Target Controller probe** connects to an EPROM (RAM EEPROM or FLASH) socket in target. It creates a "soft-interface" to the CPU core of the real target processor. This makes STIMGATE totally independent of the target processor chip and package type. It can be used with all processor derivatives in a CPU family, with external 8- or 16-bit data bus.

**CPU families currently supported:** 8051, 8086, 80186, 80386EX.



## PILOT-U40

## PILOT-U40

### Universal Programmer

- ▲ All members of the 87C196 and 87C51 families, as well as EPROMs, PALs, etc. are supported
- ▲ Controlled by IBM PCs/Notebooks, or compatibles
- ▲ Standard parallel printer port interface, no PC slot required
- ▲ Powerful, flexible, and friendly software
- ▲ Free lifetime software updates via high speed BBS
- ▲ Industrial quality
- ▲ Recognized by major semiconductor manufacturers

#### Ordering Information

- PILOT-U40: \$1,995 (USA price only). Includes interface cable, software, manual, 1-year warranty, 30-day money-back satisfaction guarantee. PLCC, SOIC, PGA, and QFP modules are optional.

#### Contact Information

Advin Systems Inc.  
1050-L East Duane Avenue  
Sunnyvale, CA 94086  
Tel: (800) 627-2456  
(408) 243-7000  
Fax: (408) 736-2503  
BBS: (408) 737-9200



#### Product Information

PILOT-U40 is the most cost-effective and reliable solution for programming devices of the 87C196 family, as well as other microcontrollers, memories, and logic devices. It is controlled by Advin's easy-to-use and fast software, operating on IBM PCs or compatibles. Since the PC interface is through a standard parallel printer port, no PC slots are required. Therefore, you get the benefit of easy portability from one PC to another. You can also operate it from a notebook computer via its standard printer port. Compared with serial-port controlled units, PILOT-U40 gives you a much faster throughput and straightforward plug-and-go interface.

Its versatile software allows you to read and save different kinds of data files including binary, and all kinds of Intel hex. The full-screen editor allows you to edit data in both hex and ASCII strings.

Its macro/batch facility allows you to collect frequently used commands in a macro file that can be submitted later for fully automated operations. This and other popular features make the PILOT-U40 a time-saving instrument for you. It also shortens the training process for your production people.

Advin Systems Inc. has been a dependable and responsive supplier of reliable programming instruments for over six years. It is recognized by major IC manufacturers. For quality-conscious engineers who need almost instant support when new devices come to market, Advin's small-company, high-quality mentality fits very well.

#### Supported Devices

- Intel 8797BH, 8797JF, 87C196JO, 87C196JR, 87C196KB, 87C196KC, 87C196KD, 87C196KR, 87C196MC, 87C196MD, 87C196NT, 87C196KQ, 87C194, and 87C198, etc.
- Intel 87C4X, 87C51, 87C51FA, 87C51FB, 87C51FC, 87C54, 87C58, etc.
- Supported packages: PLCC, LCC, QFP, and PGA
- Other supported devices: EPROMs, EEPROMs, FLASH memories, bipolar PROMs, serial PROMs, PALs, EPLDs, GALs, MACHs, MAXs, pLSIs, etc.

## Ceibo DS-51 Microprocessor Development System

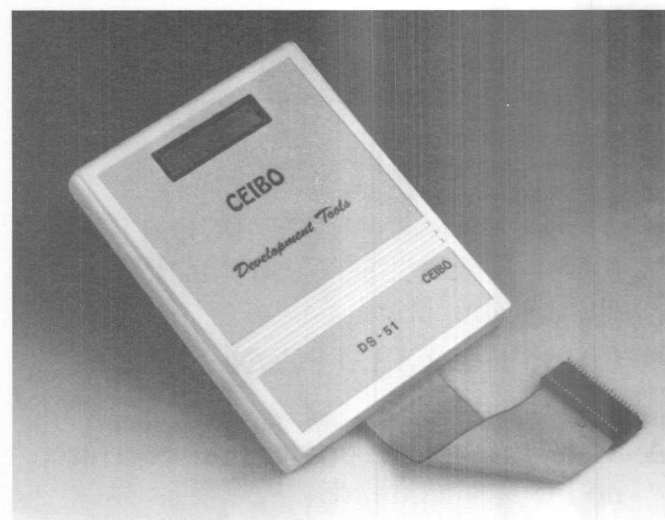
- ▲ Real-time and transparent in-circuit emulator
- ▲ 1.5 V to 6 V microcontroller emulation
- ▲ Maximum frequency of 40 MHz
- ▲ 128K of internal memory
- ▲ 32K trace memory and logic analyzer
- ▲ 64K hardware and conditional breakpoints
- ▲ Source-level debug for assembler, PL/M and C
- ▲ On-line assembler and disassembler
- ▲ Performance analyzer
- ▲ Serially linked to IBM PC or compatible host

### Contact Information

Ceibo U.S.A.  
7 Edgestone Ct.  
Florissant, MO 63033  
Toll Free (USA and Canada): (800) 833-4084  
Tel: (314) 830-4084 Fax: (314) 830-4083

France:	Tel: 62-072954	Fax: 062-072953
Germany	Tel: 061-5127505	Fax: 061-5128540
Holland	Tel: 5427-33333	Fax: 05427-33888
Israel	Tel: 972-9-555387	Fax: 972-9-553297
Italy	Tel: 051-727252	Fax: 051-727515
South Africa	Tel: 011-8877879	Fax: 011-8872051
Spain	Tel: 91-5774296	Fax: 91-5764966
Sweden	Tel: 0589-19250	Fax: 0589-16153
Singapore	Tel: 744-6873	Fax: 744-5971
Taiwan	Tel: 02-9178773	Fax: 02-9126641
Other Countries	Tel: +972-9-5615635 Fax: +972-9-553297	

email, CompuServe 75131, 1415  
Internet: 76131.1415@compuserve.com



### Product Information

The Ceibo DS-51 is a real-time in-circuit emulator dedicated to the 8051 family of microcontrollers. It is serially linked to a PC/XT/AT or compatible host and transparently emulates the target microcontroller.

DS-51 supports the new low-power and low-voltage 8051 microcontrollers and derivatives.

The system can emulate the microcontrollers using either the built-in 5 V power supply or any voltage applied to the target circuitry. The permitted voltage range is from 1.5 V to 6 V or higher.

The software includes a source-level debugger for PL/M and C, a unique assembler debugger, a performance analyzer, an on-line assembler and disassembler, conditional breakpoints, and many other features.

DS-51 accepts files generated by the most common 8051 assemblers and high-level language compilers. From your assembler, PL/M or C source-code screen, you can specify a breakpoint; redefine the program counter; execute a line step or an assembly instruction; open a flexible-in-size watch window to display variables; and use the function keys to display the trace memory, registers, and data.

Standard systems are supplied with 128K of internal memory, 64K hardware breakpoints, 32K real-time trace memory and logic analyzer with external test points, and personality probe supporting most of the 40-pin DIP or 44-Pin PLCC/QFP microcontrollers.

DS-51 emulates almost every 8051 derivative in the complete voltage and frequency range specified by the microcontroller manufacturer. The minimum frequency is determined by the emulated chip characteristics, while maximum frequency is up to 40 MHz.

### Microcontrollers Support

The DS-51 supports the following microcontrollers: 8031/2, 80C31/2, 80CL31/2, 8051/2, 80C51/2, 87C51/2, 8XC51, 8XC51FA/FB/FC and other 8051 derivatives.

# CEIBO

## ET-iC8plus Real-Time In-Circuit Emulator

- ▲ Real-time emulation up to 42 MHz
- ▲ Easy-to-use, powerful interface
- ▲ High-level debugging
- ▲ Full symbolic debugging and type checking; all popular debug formats supported
- ▲ Logic trace technology enables full trace and logic analyzer features
- ▲ 256KB/1MB overlay RAM, 256K/1M intelligent real-time breakpoints
- ▲ Background interrupt mode
- ▲ 3rd party assemblers & C compilers from Keil, Franklin, etc.
- ▲ 24-hr, 7-day, post-sale support
- ▲ 14-day evaluation period

### Processors Supported

8031, 8032, 80C31, 80C32, 80C51FA, 80C51, 80C52. The ET-iC8plus emulator comes complete with base unit, external power supply, PC interface cable, software with source level debugger, and user manual. Adapters are available for all pod to target interconnections.

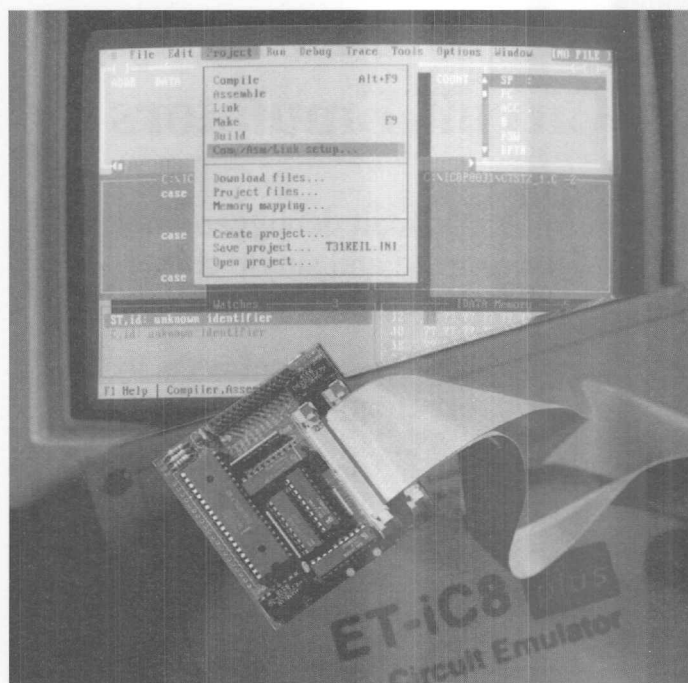
### Contact Information

Emulation Technology, Inc.  
2344 Walsh Avenue, Bldg. F  
Santa Clara, CA 95051  
Tel: (408) 982-0660  
Fax: (408) 982-0664

Ask about our 16-bit emulators, logic analyzers, universal programmers, digital storage oscilloscopes, simulators, software, and adapters.



EMULATION TECHNOLOGY, INC.



### Product Information

The ET-iC8plus' optimized, integrated environment provides for more efficient development of embedded systems. Full speed emulation up to 42 MHz means no wait states and no intrusion on I/O or interrupt pins.

The development environment includes an SAA standard user interface, a high-level debugger for C code, a multi-file editor, and a powerful, integrated project management tool. A flexible interface compliments third party C compilers, assemblers, and linkers. The environment can be configured with 1MB of overlay RAM and 1M breakpoints, a logic trace option, and a high-speed PC link.

Whether you are an experienced or infrequent user, you will find the SAA standard user interface friendly and easy to use. The interface includes on-screen editing, pull-down menus, on-line help, programmable function keys, mouse and keyboard support, powerful macros entered via command line software. Switching eliminates hardware jumpers and switches. Clock rate, clock source, VCC target, and reset from target are all controlled via the user interface.

The intelligent, real-time breakpoints can be set to stop the real-time execution of the program on fetch, read or write, at a single address or within a large range. In the background interrupt mode, non-maskable interrupts (NMI) and all other interrupts are handled even if the real-time emulation ceases. This mode can be enabled or disabled separately for NMI and all other interrupts. The trace trigger can be used to generate complex breakpoints. Trace data are displayed in disassembled format, disassembled with bus state, or in high-level statements. The built-in logic analyzer can display up to 8 channels. The optional logic pod can display up to 32 channels.

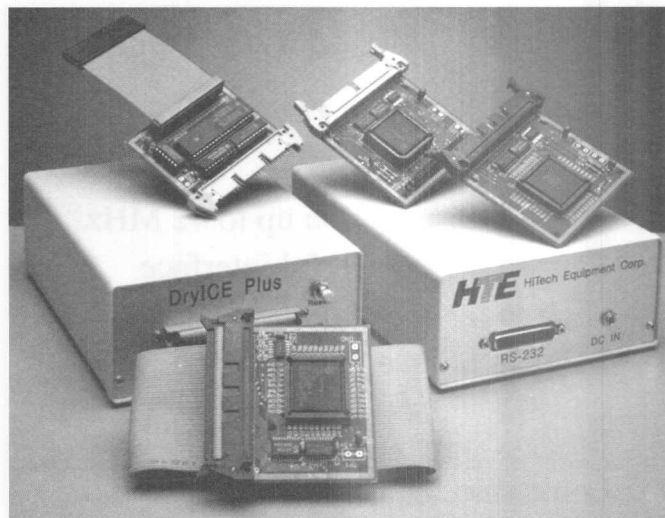
## DryICE/DryICE Plus

### DryICE 8051 Family In-Circuit Emulators

- ▲ Real-time in-circuit debugger/emulator for the expanded and single chip memory modes
- ▲ No host slots required— connects to the COM port of any PC or Mac
- ▲ UART for emulation frees processor's UART
- ▲ Help feature displays available commands
- ▲ 48K emulation RAM
- ▲ Line-by-line assembler and complete disassembler
- ▲ Prices start at \$149

#### Contact Information

HiTech Equipment Corporation  
9400 Activity Road  
San Diego, CA 92126  
Tel: (619) 566-1892  
Fax: (619) 530-1458  
email: Compuserve 70662,1241  
Internet sales@hte.com  
Hp server: ftp.hte.com



#### Product Information

The DryICE provides most of the features of an In-Circuit Emulator (ICE) at a significantly lower price. The 8051 Family In-Circuit Emulator has powerful functions to assist the designer in software and hardware development. The system integration, debug and test phases are performed faster with the DryICE. Also, there are built-in utility commands such as: *load code RAM, single step, real-time execute to a breakpoint, view and modify bit/registers/memory, fill memory, load code, line-by-line assembly, disassembly, and even a hex calculator function.*

The user can easily:

- Load and execute code.
- Interpret the results of emulation activity.
- Enter and line-by-line assemble mnemonics.
- Disassemble program memory.
- Examine and modify the CPU's internal registers/RAM, external memory, or ports.

#### Processors Supported

8031, 80C31, 8032, 80C32  
80CL51  
80C154  
80C51FA, 80C51FB, 80C51FC  
8751, 87C51, 8752, 87C52, and other 8051 derivatives

#### Host Systems Supported

PC and MAC



## 8031SBC/552SBC

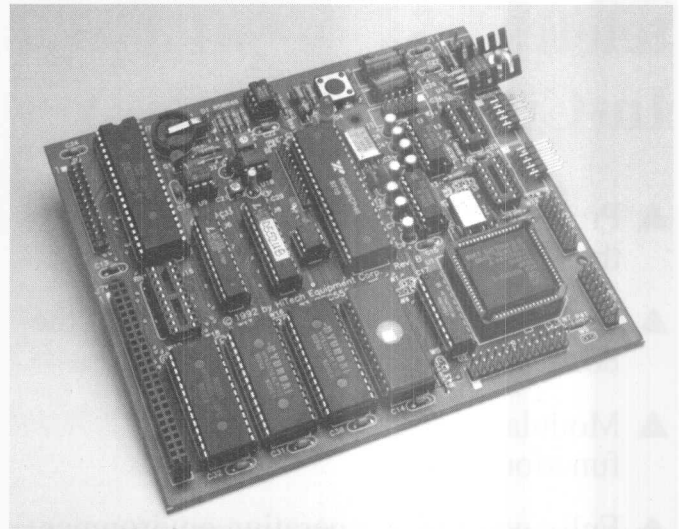
## 8051 Family Single Board Computers

- ▲ Intel 8031, 8032 microcontrollers
- ▲ 8-channel, 10-bit A/D converter
- ▲ Two pulse width modulation outputs
- ▲ One RS232 & two RS232/422/485 ports
- ▲ Battery backed real-time clock
- ▲ Four 28-pin JEDEC memory sockets
- ▲ Serial EEPROM
- ▲ 40 digital I/O lines
- ▲ Expansion connector
- ▲ Debug and test code on the SBC
- ▲ OEM 8031SBC's as low as \$49
- ▲ Custom versions, minimum quantity 25

### Contact Information

HiTech Equipment Corporation  
 9400 Activity Road  
 San Diego, CA 92126  
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 Fax: (619) 530-1458  
 email: Compuserve 70662,1241  
 Internet sales@hte.com  
 ftp server: ftp.hte.com

Agenix  
 Quarter La Baume  
 83192  
 Ollioules Cedex  
 France 8P17  
 Tel: 33 94 63 74 48  
 Fax: 33 94 63 74 49



### Product Information

The fastest way to a successful controller design is with the 552SBC Single Board Computer. All the features you want at your fingertips— an 8-channel, 10-bit A/D converter, two PWM D/A outputs and 16 digital I/Os right on the chip. This is complemented by a battery-backed, real-time clock and up to 16K bits of EEPROM for storing configuration data.

There are 24 more lines of digital I/O on an 82C55 PIO and three independent RS232 serial ports, two of which can be changed to RS422 or RS485 party line protocols with a switch of the chips. Go for more I/O— Relays, Optos, Interrupts and more— with a breadboard PCB and the Expansion Connector. Complete technical support is just a phone call away!

The SBC Family is a fast and inexpensive way to implement an embedded controller. After assembling or compiling a program, just download the HEX file to the development board RAM using the serial interface. Then single step or trace through your program. For production, just use the inexpensive OEM version with your code.

Call today, or use our Internet ftp server for more information.

## teletest 51

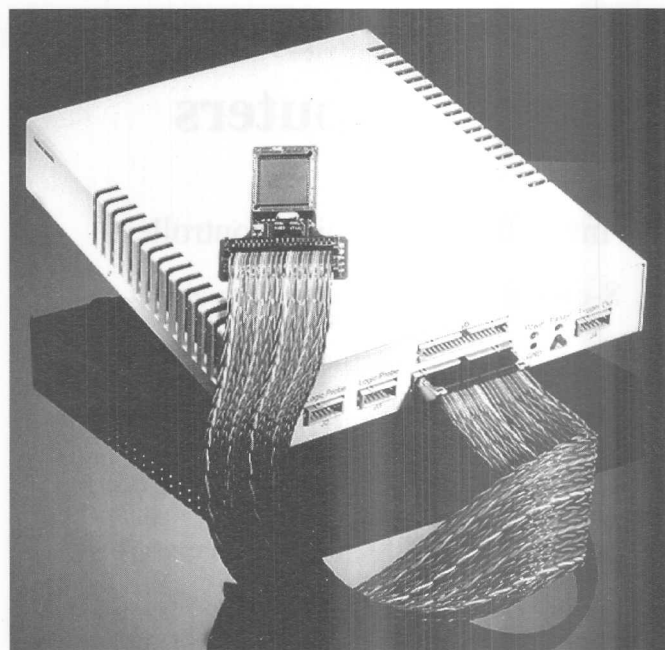
### In-Circuit Emulators

- ▲ Professional development system for the 8051 family
- ▲ Support of more than 70 variants of the 8051 microcontrollers
- ▲ Modular design and excellent functionality
- ▲ Fully windowed operating environment with HiTOP
- ▲ Runs on every PC under DOS or Windows™
- ▲ Real-time emulation up to 42 MHz
- ▲ 256K bytes of emulation memory
- ▲ 256K bytes hardware breakpoints
- ▲ Sophisticated performance analysis
- ▲ Non-intrusive access to internal RAM in real-time via triggers

#### Contact Information

HiTOOLS Inc.  
2055 Gateway Place  
Suite 400  
San Jose, California 95110  
Tel: (408) 451-3986  
Fax: (408) 441-9486

Hitex GmbH  
Greschbachstr. 12  
76229 Karlsruhe  
Germany  
Tel: (0721) 96 280  
Fax: (0721) 96 281 49



#### Product Information

The teletest 51 emulation system offers a highly modular design for powerful emulation of the 8051 family. More than 70 variants of the 8051 microcontroller family can be supported by simply exchanging the appropriate adapter cable. The teletest 51 lets you define both hardware breakpoints and complex trigger conditions. You can use them to control trace recording and the real-time counter (1 ms resolution). In addition, the teletest 51 offers you logical combination of triggers in sequences and nonintrusive, on-the-fly functions. HiTOP is the new SAA-based operating software used by all Hitex in-circuit emulators. It lets you open, position, and size windows according to your needs and gives you rapid access to all functions through either the keyboard or mouse. HiTOP supports all popular compilers and assemblers - also for banked applications - from Intel, Franklin, Keil, Archimedes/IAR, and other manufacturers. HiTOP provides you with unrestricted high-level language debugging. You can display real-time trace recording either in high-level language or assembler form. The benefits offered by the included performance analysis and coverage functions help optimize the efficiency and controllability of program flow. Thanks to the Hitex policy of continuing development and the universal approach, new versions of the rapidly growing 8051 family can be emulated immediately after their appearance on the market. All these outstanding technical features and functions have established teletest 51 as the European leader in the 8051 embedded microcontroller application development.

# hitex

## iC181 Power-Emulator for 8-bit Microcontroller

- ▲ Wide range of 8051 family support
- ▲ Integrated Development Environment
- ▲ Real-time emulation up to 42 MHz
- ▲ Banking support up to 1M byte
- ▲ HW-breakpoints up to 1M
- ▲ Intelligent breakpoints
- ▲ Break before execution
- ▲ Background interrupt/DMA mode
- ▲ Powerful trace 32K 64-bit
- ▲ Build in logic analyzer
- ▲ Integrated wave form generator
- ▲ Programmable oscillator
- ▲ Watch and call-stack window
- ▲ Code coverage monitor
- ▲ DOS and Windows™ user interface
- ▲ High speed PC link (COM, LPT, iBIT)

### Contact Information

iSYSTEM GmbH

Einsteinstr. 5 - D-85221 Dachau - Germany

Tel: +49(8131)25083

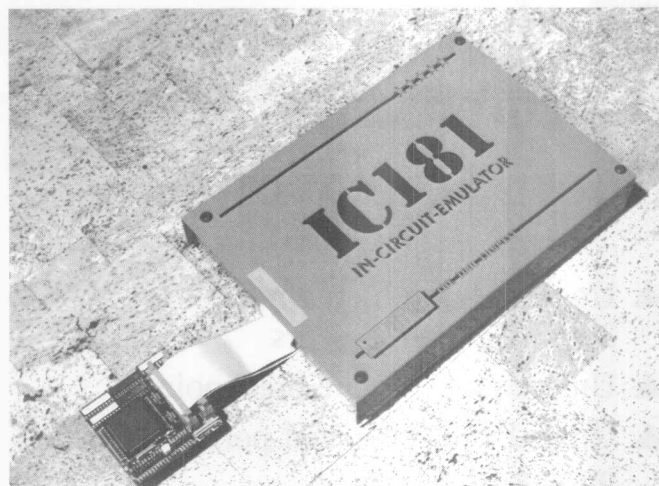
Fax: +49(8131)14024

Modem: +49(8131)1687

ISDN: +49(8131)53502

Compuserve: 100020,470

**iSYSTEM** THE TOOL COMPANY



### Product Information

The iC181 Power-Emulator for 8-bit applications is a high performance real-time development system supporting the 8051 micro controller families. It provides an optimized, integrated environment for hard and software development to shorten development cycle and to increase the productivity dramatically.

The Integrated Development Environment (IDE) is available for DOS and Windows™. It includes a project manager, a multi-file C source color editor and a high-level source debugger.

The flexible interface to third party compilers, assemblers and linkers gives the possibility to run these tools automatically from inside the IDE using the powerful MAKE and BUILD functions. All options for these tools can be set from within a dialog box.

The perfect combination and integration of all development tools in one powerful environment speeds up the development cycle extremely.

iC181 with the powerful Trace, the Profiler and the integrated logic analyzer is the right tool to get your product in-time to the market, to optimize the performance and to secure the quality of your application.

### Processors Supported

iC181 is supporting currently more than 130 micro-controllers. The flexible design of iC181 allows us to support a wide range of microcontrollers using standard and "Bond-Out" chips. We add support for new chips and families continuously. Please contact your iC181 vendor for latest information.

### Host Systems Supported

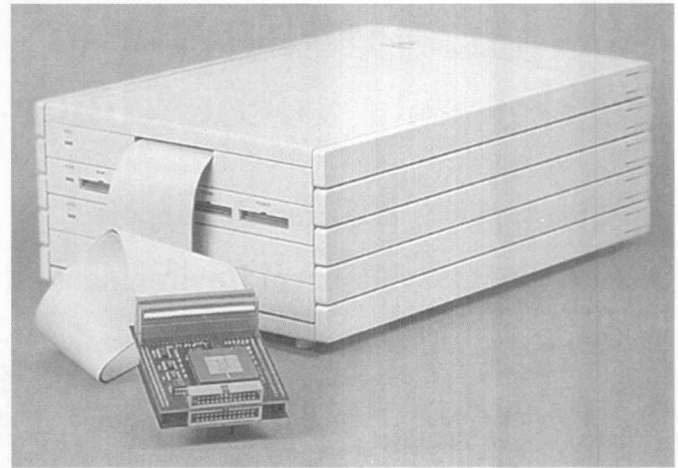
PC Platform

### Ordering Information

iC181 starts at \$2,400. US. Please contact our head office to get the address of our distributor in your country. Complete info package and demo diskette are available for free. You can download the latest demo software, technical and pricing information or latest software updates and manuals from our BBS. You can access our BBS via Modem or ISDN.

## In-Circuit Emulator for Intel MCS® 51 Microcontroller

- ▲ Universal in-circuit emulator for 8- to 32-bit microprocessors
- ▲ Unlimited hardware breakpoints
- ▲ Up to 16M Bytes dual-ported emulation memory
- ▲ High-speed link via ethernet LAN or fiber optic
- ▲ Up to 4M frame trace buffer
- ▲ Real-time trace and trigger up to 40 MHz
- ▲ Integrated high-level language debugger supports: Intel, IAR, Archimedes, Keil, Franklin, & BSO/Tasking
- ▲ Multi-task debugger
- ▲ Performance analysis and statistic functions
- ▲ Available for PC, SUN-, DEC-, VAX-, HP-workstation
- ▲ Support for more than 80 derivatives of the 8051 family
- ▲ We also support the following Intel microprocessor/microcontroller families: 80386/486, 80C186, 8086, 80196
- ▲ Timing-analyzer with pattern generator and line tester



### Product Information

The TRACE32 provides a complete set of development and testing tools. The advanced modularity of TRACE32 makes it very easy to upgrade the system to future needs. By adding or changing personality modules, another microprocessor or a new feature can be supported.

The TRACE32 has more interfaces to PCs and workstations than any other system. The communication link to the host is done by the fiber optic interface or Ethernet, allowing a high-speed transfer. Other standard interfaces such as SCSI, RS232, RS422 and a low-cost parallel connection are also supported. Software drivers are available for most systems, so it is possible to share a TRACE32 in a LAN of PCs and workstations.

The integrated HLL- Debugger, with its powerful trigger and trace capabilities, supports multi-task kernels as well as real-time systems. Interrupts can be served at any time during single-step emulation (Ada, C, C++, Modula 2, Pascal, PL/M and assembly languages supported).

The analyzer offers selective state trace as well as software performance analysis and statistic functions.

The comfortable windowed user interface is completely configurable by the user. No other system offers more flexibility. With its powerful printer interface, hard copies of windows or screens can be made in text or graphic form.

The testing language PRACTICE-II, with its macro concept, can be used for automatic hardware and software test routines.

### Contact Information

Lauterbach Datentechnik  
GmbH  
Fichtenstr. 27  
D-85649 Hofolding  
Germany  
Tel: (08104) 8943-0  
Fax: (08104) 8943-49

Lauterbach Inc.  
945 Concord Street  
Framingham, MA 01701  
USA Tel: (508) 620-4521  
Fax: (508) 620-4522



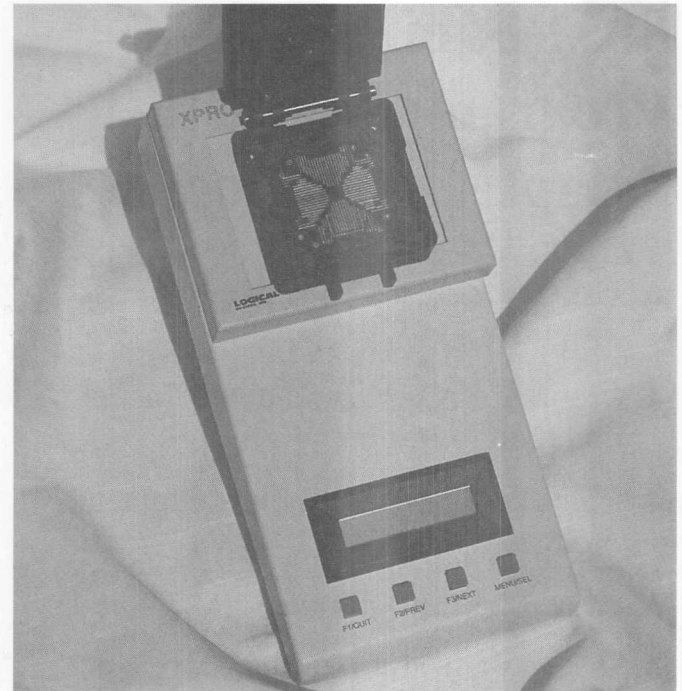
## Stand-Alone/Intelligent Universal Programmers

- ▲ Lifetime software update
- ▲ Powerful features only found in high-end universal programmers
- ▲ Direct docking support for any socket technology
- ▲ GANG head, to program 8 EPROMS at a time (optional)
- ▲ Daisy chain multiple units for production and gang programming
- ▲ Easy to use PC software included for DOS and Windows™ 3.1
- ▲ Internal battery backed up RAM
- ▲ 1 Meg internal data buffer expandable to 8 Megabits.
- ▲ Front panel LCD and display for stand-alone operation
- ▲ Software device update via BBS/floppy
- ▲ Superfast programming speed
- ▲ Support for 32 pin and 40 pin EPROMs
- ▲ Support up to 16 Meg Flash Memories

### Contact Information

Logical Devices, Inc.  
130 Capital Drive  
Golden, CO 80401  
Tel: (303) 270-6868  
Fax: (303) 279-6869

**LOGICAL  
DEVICES, INC.**



### Product Information

The XPRO family of stand alone device programmers incorporate new programming hardware and software technology and concept. XPRO architecture is based on a new pin driver system that combines functionality and low cost. The programmer incorporates several FPGAs internally to provide high level of functionality in a small package. XPRO is designed to be used in a wide variety of applications from engineering development to high volume production and field service.

XPRO is designed to program EPROMs, EEPROMs, CMOS PROMs, Flash, EPLDs, Single Chip Micros, FPGAs. The full system consists of a base programming system and an appropriate socket adaptor. Refer to the full list of devices and family adapters for the desired configuration.

This product operates from a high speed serial RS232 port and is fully compatible with all of the laptop computers, Macintosh, Sun Workstations, Power PCs, and all of the IBM PC compatibles, including 486-66 MHz and Pentium® processor based products. One year warranty, parts and labor are included.

### Ordering Information

PROXP1-101	1 MEG BASE / 110VAC 60 HZ
PROXP1-104	2 MEG BASE / 110 VAC 60 HZ
PROXP1-108	8 MEG BASE / 110VAC 60HZ
MODXP1-UM1	Universal Memory Adapter
MODXP1-GD32	Gang of 8 EPROM Adapter
MODXP1-XXX	Refer to full list

Call 1-800-331-7766, Visa, MC, American Express accepted. Delivery: From stock, over 300 locations worldwide. Direct Federal Express shipment to anywhere in the world in 48 hours.

## 8051 Adapters

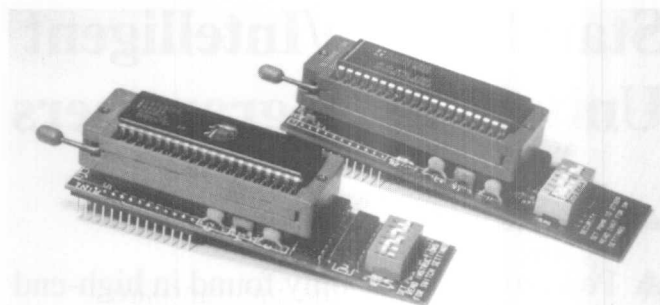
## 8051 Family Programming Adapters and Socket

- ▲ Use new devices on your current programmer
- ▲ Program 87C51's, and others in common footprints
- ▲ Eliminate expensive new equipment purchases
- ▲ Easy to use; no software
- ▲ Receive friendly technical support
- ▲ Use high quality Textool, Yamaichi, and Enplas socket
- ▲ Priced from \$60 to \$225
- ▲ 30-day satisfaction guarantee
- ▲ New designs being released all the time, call us with what you need

### Contact Information

Logical Systems Corp.  
P.O. Box 6184  
Syracuse, NY 13217-6184  
Tel: (315) 478-0722  
Fax: (315) 479-6753

**LOGICAL**  
SYSTEMS



Device	40 DIP ZIF 27512	40DIP ZIF 2732A
87C51,'52, -FA	✓	✓
-FB, -FC	✓	✓

### Smart Adapters

These adapters include circuitry to allow 8751 devices to be programmed in standard EPROM footprints. All security features are available. DIP switches select the programming function. All lockbits as well as the encryption array can be programmed.

Device	PLCC 40 DIP	QFP 40 DIP
87C51,'52	✓	✓
-FA, -FB, -FC	✓	✓
87C51-GB	✓	

### Programming Adapters

These adapters let you program 87C51s, 'GBs, and others in common footprints.

Device	DIP ZIF PLCC	PLCC PLCC	PLCC PGA
87C51,'52	✓	✓	✓
-FA, -FB, -FC	✓	✓	✓

### Development Adapters

These adapters simplify prototyping and development. They plug into a production socket and provide a test socket or compatible device.

PLCC 27512
Means PLCC top socket and 27512 DIP plug bottom

### Ordering Information

- Visa, Mastercard, Discover, Amex, COD or Pre-payment by check. Purchase orders accepted from approved companies.
- UPS ground delivery included.
- For custom work contact Mitchell Burko.

## iceMASTER-AA™ 8051 Family of In-Circuit Emulators

- ▲ Full-featured, real-time and transparent emulator
- ▲ Supports 8051 family devices up to 24 MHz
- ▲ Provides interchangeable probe cards
- ▲ Can be hosted on any PC or compatible including laptops, notebooks, or PS/2 systems
- ▲ Provides fast 115K baud serial link using a standard communication port
- ▲ Hardware features:
  - 64K program and 64K external data memory
  - 4K frame trace buffer
  - Advanced trace search ability
  - 128K hardware breakpoints
  - 64K trace ON/OFF triggers
  - Dual performance analyzers
- ▲ System features:
  - Efficient, powerful, easy to learn
  - Third-party Assembler and Compiler support
  - Full symbolic and source-level debug
  - Full Intel 8051 derivative device support
  - Windowed user interface with control of size, content, position and color
- ▲ Full support for structures, unions, arrays, pointers

### Contact Information

Your local MetaLink sales office or distributor or:  
MetaLink Corporation  
325 E. Elliot Road  
Chandler, AZ 85225  
Tel: (602) 926-0797  
Fax: (602) 926-1198



### Product Information

The iceMASTER-8051 emulator represents a culmination of over eight years of focussed engineering to bring the most advanced semiconductor technologies to emulator design.

The iceMASTER-8051 emulator offers real-time and transparent emulation at up to 24 MHz for 8051 derivative devices. A powerful breakpoint system allows you to stop a program any time and examine all states and conditions. Trace memory provides a complete history of each event that has occurred, including source-level information, address, data, status, searching, external logic events, and a logical analyzer display. The best performance-analyzer capability in the industry allows a thorough evaluation of the program to decide what areas are taking the most time and simplify those areas requiring improvement. The iceMASTER-8051 emulator supports symbolic and source-level debugging for the widest variety of third-party translators, including Cross Assemblers, Basic Compilers, 'C' Compilers, and PL/M Compilers. These capabilities allow you to debug your system the way you designed it, at the symbolic or source level. This increases your productivity, while decreasing your cost and time to market.

The iceMASTER-8051 emulator provides pull-down and pop-up menus, function/hot keys, and context-sensitive hyperlinked HELP. The advanced color windowed user interface is easy to use. You can size, move, scroll, highlight, color-control, add or completely remove each window. You can also peruse and directly alter the contents of any memory space from the appropriate window, with multiple memory spaces displayed simultaneously.

### Host System

IBM PC, XT, AT, 386, 486, Pentium® processor, PS/2, notebook, laptop or a completely compatible system.

### Processors Supported

8031, 80C31, 8x51, 8xC51, 8032, 80C32, 8x52, 8xC52, 8xC51FA, 8xC51FB and 8xC51FC.

Call about others not listed. A full range of NMOS, CMOS, EPROM, and OTP technology and process variations are supported.

### Typical System Prices

Without Trace Memory	About \$2000
With Trace Memory	About \$3200

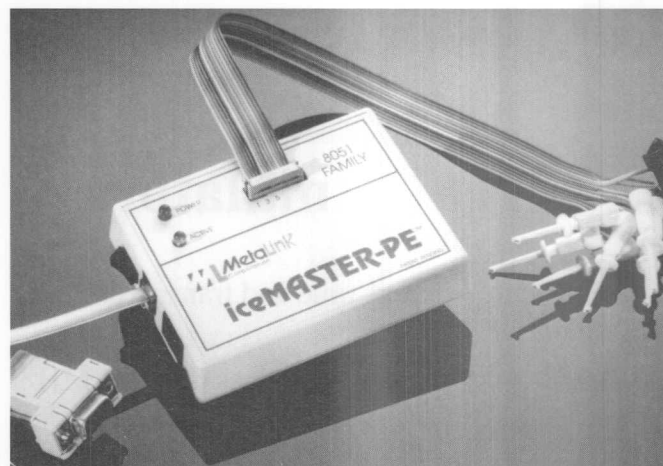
## PE 8051 Family

# iceMASTER-PE™ 8051 Family of In-Circuit Emulators

- ▲ Full-featured, real-time and transparent emulator
- ▲ Supports 8051 family devices up to 42 MHz
- ▲ Supports 8031s, 8032s or 8x51s, 8x52s, and 8xC51FXs
- ▲ Integrates emulation and probe electronics into a single package
- ▲ Plugs directly into target applications or operates in a stand-alone mode
- ▲ Based on patented AET design architecture
- ▲ Hardware features:
  - Up to 64K program and 64K external data memory
  - 16K frame trace buffer
  - View trace while executing
  - Up to 128K hardware breakpoints
  - Up to 64K trace ON/OFF triggers
  - Integrated self-test capabilities
- ▲ System features:
  - PC-hosted via RS 232 serial link
  - Efficient, powerful, easy to learn
  - Windowed user interface with control of size, content, position, and color
  - Third-party Assembler and Compiler support
  - Full symbolic and source-level debug
- ▲ Full support for structures, unions, arrays, pointers

## Contact Information

Your local MetaLink Sales Office or Distributor  
MetaLink Corporation  
325 E. Elliot Road  
Chandler, AZ 85225  
Tel: (602) 926-0797  
Fax: (602) 926-1198



## Product Information

The unique iceMASTER-PE packs advanced features into a tiny, palm-sized package that any engineer can afford. Designed for demanding projects, iceMASTER-PE supports frequencies up to 42 MHz with a full complement of emulation memory, external data memory, and a transparent trace buffer 16K frames deep with advanced searching capabilities.

The iceMASTER-PE is the world's most portable emulator because both the emulator and probe electronics are integrated into a package the size of a PC mouse. The entire emulator plugs directly into the target applications or operates in a stand-alone mode.

The iceMASTER-PE windowed user interface delivers the highest development productivity. Its context-sensitive hypertext and hyperlinked help system makes this interface easy to learn and easy to use. This powerful, productive interface gives you total control and flexibility in the configuration of the size, position, content, and color of each window.

The iceMASTER-PE includes a full symbolic and source-level debugger for Assemblers and Compilers. The emulator supports the most popular 8051 Assemblers and Compilers.

The iceMASTER-PE sets the standard for value in 8051 family emulation.

## Ordering Information

PE-8032, PE-83752 and PE-8351FX.

## Includes

Emulator, RS 232 cables, power supply, and FREE 8051 Macro Cross Assembler.

## Host System

IBM PC, XT, AT, 386, 486, Pentium® processor, PS/2, notebook, laptop, or a completely compatible system. Prices start at \$851 (US Retail Price).

PE Product	Max. Freq.	Processors Supported
8351FX	16 MHz	8x51, 8xC51, 8x52, 8xC52, 8xC51FX
8032-24	24 MHz	8031, 80C31, 8032, 80C32
8032-42	42 MHz	8031, 80C31, 8032, 80C32



## EMUL51-PC

## EMUL51-PC

- ▲ Support for all 8051 derivatives
- ▲ Real-time emulation at maximum chip speed
- ▲ Use of bond-out, hooks or regular chips for accurate emulation
- ▲ Choice of host hardware interfaces: PC plug-in, RS 232 port or workstations via LanICE
- ▲ Choice of User Interface:
  - a) Microsoft® Windows™ or OS/2
  - b) DOS based Borland keypress compatible (Chipview)
  - c) DOS based command line/pull-down windows
  - d) Several third party interfaces
- ▲ High Level support for popular C-compilers
- ▲ Real-time trace boards, up to 256K deep, 64 bits wide, with eight trigger levels, timestamp and filtering
- ▲ Unlimited breakpoints, bankswitch, program performance analysis

To learn more, please call (408) 866-1820 for a FREE Demo Disk. For more information via your Fax, call our 24-hour Information Center at (408) 378-2912

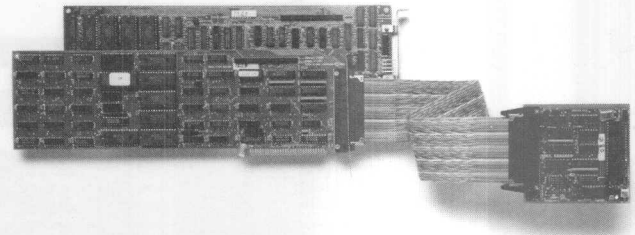
**Contact Information**

Nohau Corporation  
 51 E. Campbell Ave.  
 Campbell, CA 95008  
 Tel: (408) 866-1820  
 Fax: (408) 378-7869

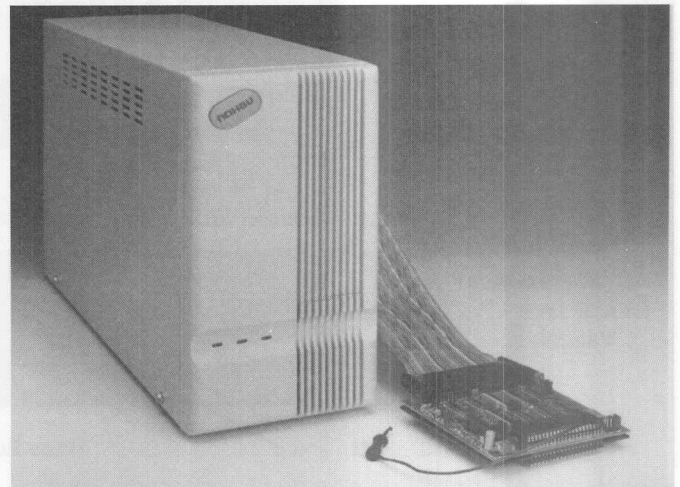
See page 165 for Nohau's representative in your area

**NOHAU**  
 CORPORATION

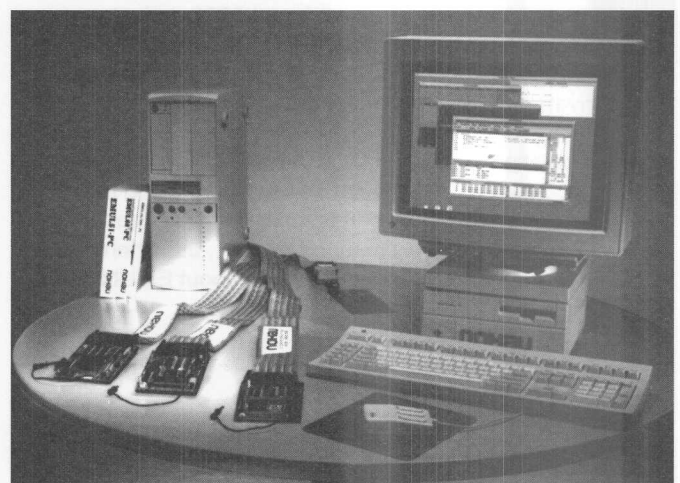
Hosted on PC's and workstations.



The emulator was designed to be plugged into a full size PC AT style slot. The optional trace needs a second slot.



These same boards can also be supplied in an "RS-232 box" which communicates with the PC over a standard COM port.



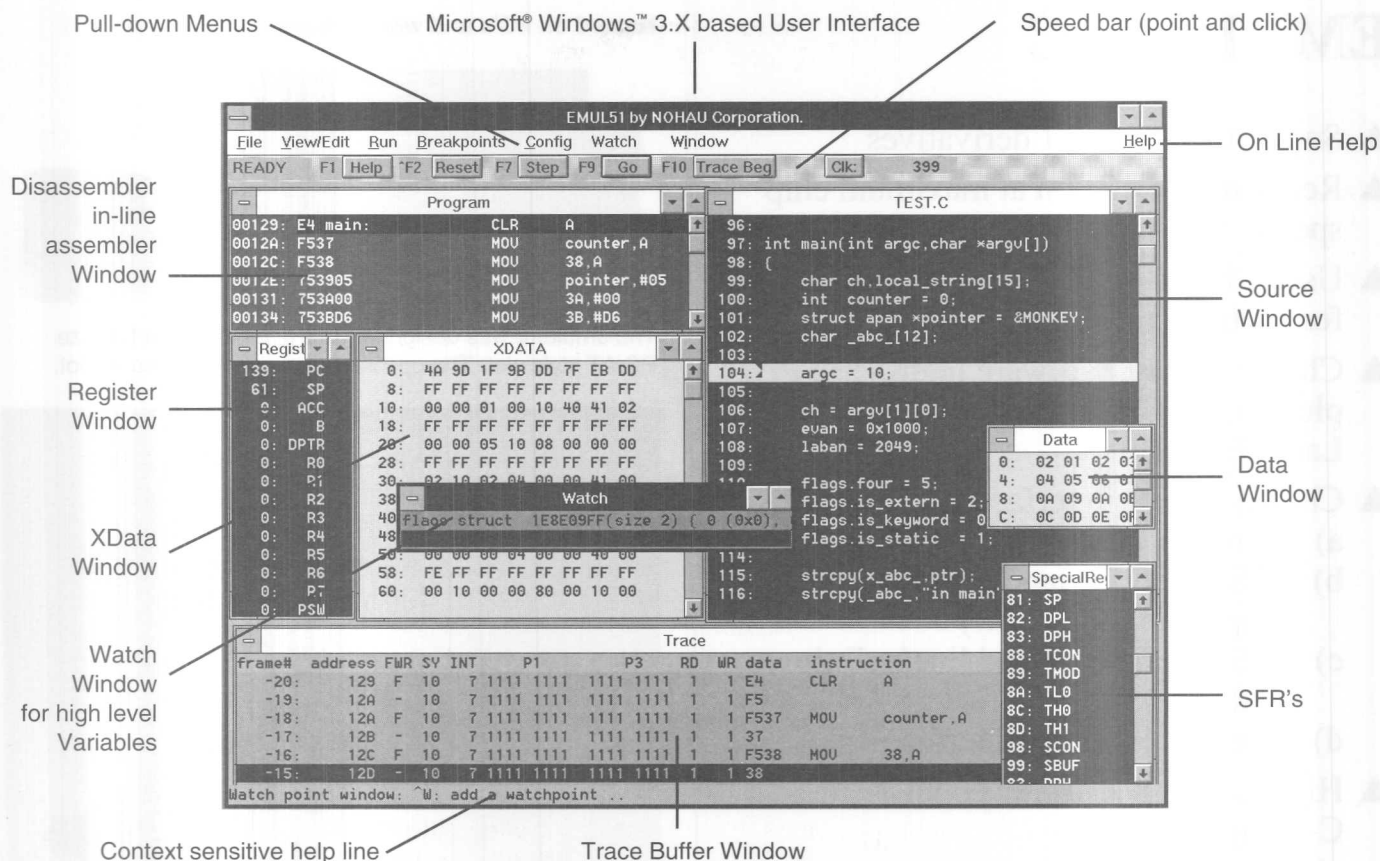
To use the EMUL51-PC on XWindows workstations such as SUN or HP, the Nohau LanICE is available. Because LanICE uses a high-speed (10 Mbit/second) local area network, not only can it be placed far away from the workstation, but it maintains the relatively high code loading speed of the Nohau emulators plugged into your PC on your desktop.

(continued)

## EMUL51-PC

(continued)

8051

**The world's most popular 8051 emulator.**

Since its introduction in 1986, Nohau has delivered over 10,000 EMUL51 PC emulators. And each emulator is often used in several projects where different 8051 derivatives are used. Since the emulator supports virtually all 8051 derivatives, only a change of the probe is required when a new derivative needs emulation support.

The EMUL51-PC's popularity is built on a solid word-of-mouth reputation of being a feature-rich product with excellent customer support. When we advertise the EMUL51-PC we boast about all the features like high-level debugging, bond-out support, multi-level triggering etc., but when we ask our customers about what they like best about EMUL51-PC the answer often is "it works".

**Contact Information**

Nohau Corporation  
51 E. Campbell Ave.  
Campbell, CA 95008  
Tel: (408) 866-1820  
Fax: (408) 378-7869

**nohau**  
CORPORATION

**Choice of different user interfaces.**

Early in the evolution of the EMUL51-PC's user interface it became clear that each customer had different opinions of how they would like the interface to work and what features are important to them. On these pages we show two of the three main user interface choices for the EMUL51-PC: Microsoft® Windows™ 3.x, and ChipView's Borland Keypress compatible. Nohau's original pull-down/command line is not shown. For an even better look at the Microsoft Windows interface, please see our ad on the back inside cover. Recognizing EMUL51-PC's enormous popularity, several third party compiler vendors have ported their user interfaces to the EMUL51-PC to provide emulator interfaces similar to their simulator interfaces. Among these vendors are: Intermetrics/Whitesmiths, Keil, Franklin and Production Languages Corporation.

**In-depth support for all of Intel's 8051 derivatives.**

Several years before Intel decided to withdraw from making 8051 emulators, they chose Nohau to be the only third party vendor to get access to their "bond-out" chip for the 80C51FX series. Nohau also has the only emulator for the 80C51SL series. The latest pod supports the 80C51FX in 3V operation.

See page 165 for Nohau's representative in your area.  
See our ad on the inside back cover.

(continued)

# EMUL51-PC

## System Specifications

### Supported Intel 8051 Derivatives

8051, 8052, 8031, 8032, 80C51, 80C31, 80C32, 87C51, 80C152, 8XC51FA, FB, FC, 80C51GB, 80C51SL, 80C51RX, 8XC54, 8XC58, 80C51FX-3V, and 80C51SL-3V

### Host

- IBM PC/XT/AT, PS/2 or compatible
- Minimum 512K of RAM
- Monochrome, CGA, EGA or VGA in 25-, 43-, or 50-line mode
- Sun, HP and other workstations

### External Box

The emulator boards can be installed in an external box with serial or parallel communication to the host computer.

### Languages Supported

- Third-party assemblers, C-51 and PL/M-51

### High-Level Debugging

- Window for source-level debugging
- Single Step or Line Step with breakpoints marked directly in the code
- Full support of local and global variables in C-51
- We currently support Franklin, Keil, Archimedes/IAR, Intermetrics/Whitesmiths/Cosmic, and BSO/Tasking

### In-Line Assembler and Disassembler

- Full instruction set and symbols supported

### Symbolic Support

- Full symbolic debugging and type checking
- Same symbols can be used in different modules
- All special functions registers supported

### Contact Information

Nohau Corporation  
51 E. Campbell Ave.  
Campbell, CA 95008  
Tel: (408) 866-1820  
Fax: (408) 378-7869

**noHau**  
CORPORATION

### File Formats Supported

- Intel HEX/OBJ/OMF/SYM
- Avocet
- Archimedes/IAR
- Keil, Franklin
- 2500 AD
- Intermetrics
- BSO/Tasking
- and many more

### Execution Timer

- Resolution down to 182 ns

### Real-Time Emulation

- Full-speed emulation up to 42 MHz
- No wait states and no intrusion on memory, stack, I/O or interrupt pins

### Emulation Memory

- 64K XDATA memory and 64K CODE memory
- Up to 320K bank-switched memory as option
- Memory mapping
- Mappable in 4K pages

### Macros

- Test session automation and macro command definition
- IF/ELSE, REPEAT/WHILE structures

### Debug Session Logging

- Record emulation session and all setups to a file

### Breakpoints

- 64K program breakpoints. Breakpoints can be selected to break before or after execution of the breakpoint instruction
- 64K data read and 64K write breakpoints
- Break on external signal
- Break on direct access to internal bit or byte memory
- Break on range of addresses and high-level language statements
- Break on program execution out of boundaries
- With the trace board option, it's possible to break on any 48-bit combination of address, data, RD, WR, OP code fetch, interrupt level, ports, or external signals

### Single Stepping

- Single or multiple instruction stepping
- Step over calls and interrupts
- Line stepping in high-level languages

### Real Time Trace

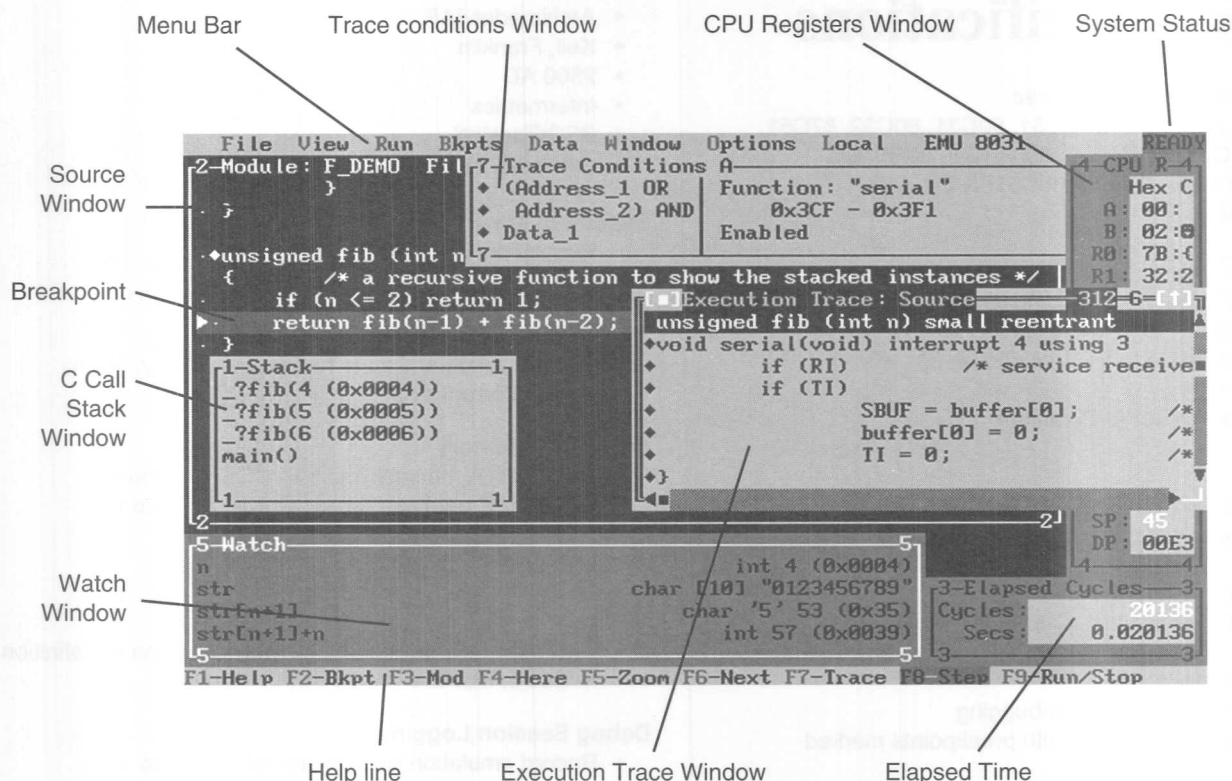
- Up to 256K deep, 64 bits wide with timestamp
- 8 trigger levels, filtering
- Program performance analyzer
- On-the-fly timer

See page 165 for Nohau's representative in your area.  
See our ad on the inside back cover.

## ChipView-51

## ChipView-51 Screen for Nohau

Borland Key Press Compatible



## EMUL51-PC and ChipView-51

As you can see on the screen shown above, ChipView-51 supports multiple, overlapping, fully moveable and resizable Windows.

You can see all of your variables (global & local) at once in the Variables Window, or just track a few expressions in the Watch Window. Complex arrays and structures can be decomposed across several inspector windows. Linked lists can be browsed and dynamically updated every time the emulator hits a breakpoint.

## Full Mouse Support

By simply clicking on source lines with a mouse, you can toggle breakpoints; click on variables or expressions to watch or inspect them; drag and resize windows to suit your needs; and then save the entire setup for later sessions. Click on 'Build' to shell into your favorite editor at the exact line you're debugging, then re-compile and reload automatically. ChipView-51 restores all breakpoints, watches, etc. in the fresh object, ready for more testing.

**NOHAU**  
CORPORATION

## Enhance EMUL51-PC

ChipTools has worked closely with Nohau to ensure that ChipView-51 provides total support for all EMUL51-PC hardware options - including standard and advanced trace boards, standard and bankswitch emulator boards, PC plug-in and serial box options, as well as all pods.

ChipView-51 maximizes trace performance of the EMUL51-PC - you can trace general program flow by capturing just one frame per source line, mixed with detailed trace only where you need it, by 'OR'ing in selected functions—all by point & click. Debugging bank-switched code is a breeze, as ChipView-51 correctly decodes traced source by banks, and even displays bank-to-bank calls in the C call stack Window for both Franklin, Keil and Archimedes/IAR Banking C-compilers.

## Support

- IBM AT or compatible, 2MB RAM.
- High-level support for C compilers from Archimedes, BSO/Tasking, Franklin, Keil and IAR.
- Source-level support for Assemblers and PL/M-51 compilers from Intel. Others supported at OMF51.

See page 165 for Nohau's representative in your area.  
See our ad on the inside back cover.



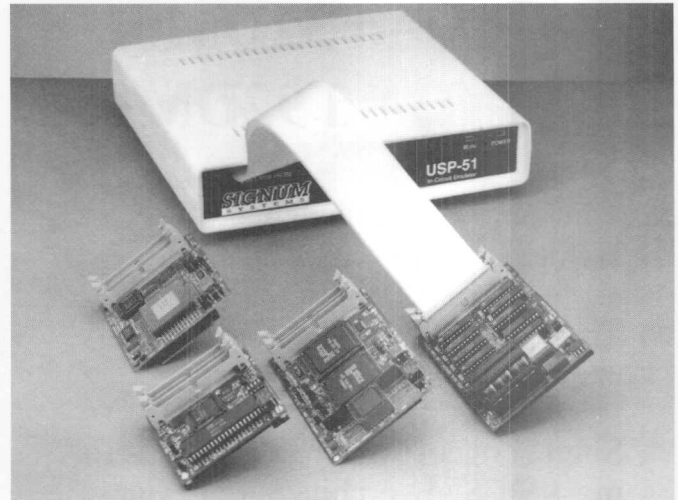
## MCS<sup>®</sup> 51 Microcontroller In-Circuit Emulator

- ▲ Up to 256KB of dual-ported zero-wait-state emulation memory allows read & write access during execution
- ▲ Non-intrusive emulation up to 42 MHz
- ▲ Supports nearly all 8051 derivatives (5V & 3V)
- ▲ Breakpoints on register values and internal data
- ▲ Source level debugging for ASM, C, & PL/M
- ▲ 32K by 80-bit selective trace buffer
- ▲ 32-bit synchronized time stamp
- ▲ Complex hardware breakpoints and passpoints
- ▲ Unlimited address and data match breakpoints
- ▲ Software performance analysis
- ▲ Execution coverage monitor
- ▲ High speed serial interface to a PC host (no plug-in cards)
- ▲ Windows<sup>™</sup> and MS-DOS user interface

### Contact Information

Signum Systems  
171 E. Thousand Oaks Blvd., #202  
Thousand Oaks, CA 91360  
Tel: (800) 838-8012  
Tel: (805) 371-4608  
Fax: (805) 371-4610

**SIGNUM**  
SYSTEMS



### Product Information

USP-51 gives true real time in-circuit development and debugging in machine code, assembler source, and High Level Language (HLL) modes.

USP-51 comes complete with 64KB of code memory (256 KB true banking model optional), 64KB xdata memory, source debugger for C, PL/M and ASM, 80-bit wide by 32K deep trace, and a sophisticated Event Triggering System that uses a combination of address comparators, data comparators, sequencer, external probes, and pass counters to create almost any complex trigger condition.

Equipped with zero-wait-state, dual-ported memory, the emulator allows reading and writing to its memory while the processor is running in real-time. Watching and modification of variables and parameters may be done without stopping the processor and waiting for the motors or systems to stabilize each time.

Selective tracing of only meaningful data is easily achieved with the aid of the Event Triggering System. A 32-bit time stamp, synchronized to the processor clock, shows exact time relationships between instructions and routines, in absolute or relative display modes.

The HLL debugger provides support for all of the popular C and PL/M compilers. Unlimited number of breakpoints and passpoints may be set or cleared with a mouse, by simply clicking on the desired instruction in the Source window. You can watch variables change on-the-fly, and zoom in on a member of complex structure with a click of a mouse.

Emulation CPU (either bondout or standard) is mounted on probe assembly, as close as possible to target system for the best possible emulation.

### Other products

Signum carries a full line of emulators for 80C51, 196, 186, 386, 486.

## 32GPX and 32DM01 TLA510 and 92DM901

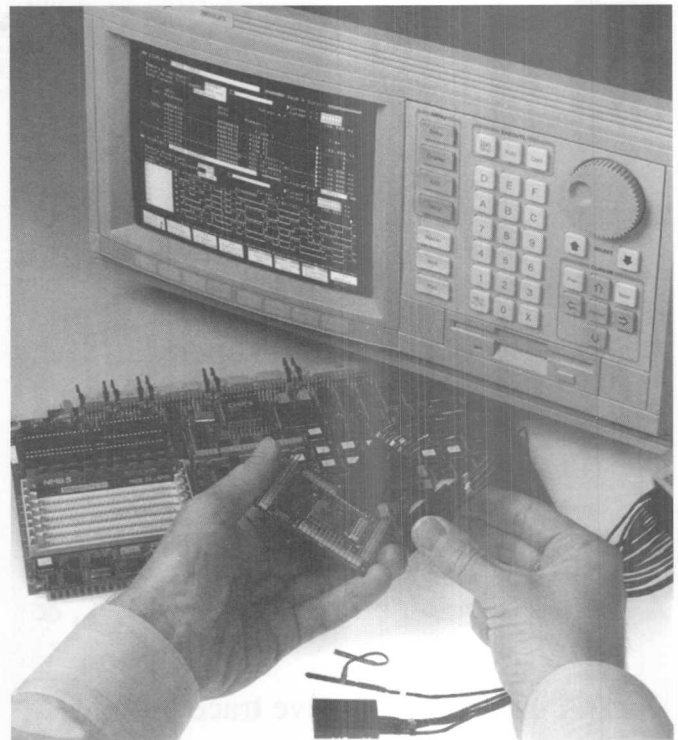
- ▲ Real-time symbolic debug of MCS® 51 architecture systems
- ▲ Trace identifies instructions actually executed and branches taken
- ▲ Single connection probe adapters for most MCS® 51 architecture devices
- ▲ 80 to 100 MHz state acquisition
- ▲ Timing analysis on all channels through same probe adapter
- ▲ Real-time performance analysis
- ▲ Links to high-level languages
- ▲ Prices start at \$9,000

### Contact Information

Tektronix, Inc.  
P.O. Box 1520  
703 West Housatonic Street  
Pittsfield, MA 01202-9864  
Tel: (800) 426-2200  
Fax this page with your business card attached to  
Fax: (413) 448-8003  
WWW: <http://www.tek.com>

# Tektronix

## 32GPX and 32DM01 TLA510 and 92DM901



### Product Information

The GPX Logic Analyzer is a general-purpose instrument with features for everyone on the design team. Complete systems for microprocessor analysis start at \$9,000. The GPX series comes in a 3001GXP monolithic unit or a 3002 modular mainframe. Both units offer a 64MB hard disk and an MS-DOS compatible floppy for data storage, keyboard, and a variety of monochrome and color displays. The GPX offers 80 to 160 channels of 80 MHz state acquisition; 200 MHz transitional timing analysis on all channels; 16 to 32 channels of 1GHz timing acquisition (40K deep); true simultaneous state and timing analysis without double probing; real-time performance analysis; and links to high-level languages such as C, C++, Pascal, and Ada.

The TLA510 Logic Analyzer is a modular instrumentation platform that you can operate locally using a color X-terminal or from a workstation via a standard X11/R4 server. Host communication is supported via LAN, or RS 232. The TLA510 contains a highly integrated acquisition module designed specifically to address the demanding requirements of the fast, wide, complex buses of today's microprocessors. The 96 channels of 100 MHz synchronous acquisition on each module lets you use multiple modules to support multiple microprocessors with no compromises in speed or timing. Memory depths from 8K samples to 2M samples let you capture both the symptom and cause of complex problems. The DAS/NT offers software performance analysis at full speed with up to 5,000 symbolic ranges.

# Section IV

## MCS<sup>®</sup> 96 Microcontroller Development Tools

COMPANY	PRODUCT	MCS® 51	MCS® 251	MCS® 96	80C186	PG.
ARCHITECTURES						
Intel MCS® 96 Microcontroller Family (Article)						100-02
Software Development Tools						
BSO/TASKING	C 196 Total Development Solution			X		103
BSO/TASKING	ChipView-196 Debugger			X		104
BSO/TASKING	196 Assembler			X		105
ChipTools	ChipView-196 High-Level/Low-Level Debugger			X		106
Embedded Sys. Products	RTXC Real-Time Executive in C	X		X	X	107
IAR Systems	8096/196 Compiler			X		108
Inform Software	fuzzyTECH Fuzzy Logic Development System	X		X		109
Intel Corporation	Project Builder 196			X		110
Intel Corporation	fuzzyBUILDER Fuzzy Logic Dev. Software	X	X	X		111
Intel Corporation	ApBUILDER Interactive Programming Software	X	X	X	X	112
Hardware Development Tools						
BYTEK	87C196 Special Support Package	X		X		113
CheckMate Systems	CheckMate II-C196K Emulator			X		114
iSYSTEM	iC196 Power Emulator			X		115
Lauterbach Datentechnik	TRACE32 In-Circuit Emulator			X		116
Nohau Corporation	EMUL196-PC In-Circuit Emulator			X		117-19
Orion Instruments	8800 Emulator/Analyzer			X		120
Signum Systems	USP-96, USE-96NT In-Circuit Emulator	X		X	X	121
Tektronix	32GPX and 32DM81, TLA510 and 92DM81			X		122

# MCS<sup>®</sup> 96 Microcontroller Family

*Intel's MCS<sup>®</sup> 96 microcontroller product family is the industry standard for 16-bit embedded microcontrollers. The 8XC196 products are found in a variety of embedded applications. The high-performance register-to-register architecture is well suited for complex real-time control applications such as hard disk drives, modems, printers, pattern recognition and motor control. Our broad portfolio of 8XC196 microcontroller products has been designed to meet your varying peripheral, memory size, addressability and performance requirements.*

The 8XC196 family shares a common core architecture which is register based. The MCS<sup>®</sup> 96 microcontroller register architecture eliminates the accumulator bottleneck and enables fast context switching. All devices have bit, byte, word and some 32-bit operations. The following table summarizes the capture and generation of high speed signals on the HSO and EPA:

The 8XC196 Bus Controller features programmable wait state generation, 8- or 16-bit bus width and features a HOLD/HLDA protocol for multiprocessor systems. The newest member of the MCS<sup>®</sup> 96 microcontroller family, 8XC196NU, operates at 50 MHz and has a demultiplexed address/data bus.

The MCS<sup>®</sup> 96 microcontroller product family has three distinct product lines. The most recent products form the EPA family. This family of devices has the advanced peripherals which include a flexible input/output system and EPA (Event Processor Array). The HSIO family consists of devices that have the High Speed Input/Output sub-system. The Motion Control family is comprised of devices that support motor control applications. This family also uses the EPA system for I/O control.

## HSIO Family

*The HSIO family includes the 8X196KB, 8X196KC and 8X196KD.*

### 8X196KB

The 8XC196KB is the first member of the CHMOS<sup>\*</sup> MCS<sup>®</sup> 96 controller family.

OPERATION	16 MHz	20 MHz	25 MHz	50 MHz
HSI (High Speed Input)	1.125µs	900 ns		
HSO (High Speed Output)	1 µs	800 ns		
EPA (Event Processor Array)	250 ns	200 ns	160 ns	80ns

It is available in CPU only 8K byte ROM, and 8K byte OTPROM versions. All versions feature 232 bytes of register RAM.

The 8XC196KB uses the High-Speed Input/Output (HSIO) structure for event control. The HSIO has up to 4 input and 6 output lines, and uses either of two 16-bit timer/ counters as a time base. Additional features include a hardware-generated Pulse Width Modulator (PWM), a full-duplex Serial I/O (SIO) port, a watchdog timer and 8-channel 10-bit resolution Analog to Digital (A/D) converter.

The 8XC196KB has 48 Input/Output (I/O) lines which are shared with the peripherals.

### 8X196KC

The 8XC196KC is the next step up in the CHMOS 196 family. It is available in CPU 16K byte ROM and 16K byte OTPROM versions. All versions feature 488 bytes of Register RAM.

The 8XC196KC is offered in a 20 MHz version, allowing an immediate 25% increase in performance.

The 8XC196KC has all the same peripherals as the 8XC196KB, but adds the following features: There are now a total of three hardware PWM generators, the A/D converter has both 8- and 10-bit conversion modes with programmable sample and conversion times, and a Peripheral Transaction Server (PTS) has been added. The PTS acts as a microcoded interrupt handler which greatly reduces CPU overhead during interrupt servicing.

### 8X196KD

The 8XC196KD has all the features of the 8XC196KC, but has extended the on chip memory. The 8XC196KD is available in 32K byte ROM and 32K byte OTPROM versions. Both versions feature 1000 bytes of Register RAM. With the availability of 32K of memory, program development in high level languages becomes much more practical. The 8XC196KD is also offered

in a 20 MHz version.

### Key Features

- Up to 20 MHz Operation
- Fast Register to Register Architecture
- Up to 1000 Bytes Register RAM
- Up to 32K internal OTPROM
- Dynamically Configurable 8- or 16-bit Buswidth
- HOLD/HLDA Bus Protocol
- 8-Channel High Speed I/O (HSIO) Subsystem
- 16-bit Timer
- 16-bit Counter
- Up to 3 Dedicated PWM Generators
- Full Duplex Serial Port
- 16-bit Watchdog Timer
- Five 8-bit I/O Ports
- IDLE and POWERDOWN Modes
- Peripheral Transaction Server (PTS) on KC and KD

## EPA Family

*The EPA family includes the 8XC196KR, 8XC196KT, 8XC196NT, 8XC196NP and 8XC196NU.*

### 8XC196KR

The 8XC196KR is a highly integrated, advanced member of the MCS<sup>®</sup> 96 controller family. The 8XC196KR has an optional 16K byte OTPROM and has 488 bytes of Register RAM and 256 bytes of Internal RAM. The Internal RAM can be used for program execution or data storage.

The 8XC196KR uses a modular Event Processor Array (EPA) for event monitoring and control. The EPA has a 250 ns resolution at 16 MHz, and has 10 capture/compare modules plus two compare only modules. The EPA is extremely flexible, and has pulse-width modulation (PWM) generation capability.

The 8XC196KR includes the Peripheral Transaction Server (PTS) with modes to support PWM generation with the EPA.

The 8XC196KR has a slave port which is used to interface to another systems bus.



The slave port feature can be used to make the 8XC196KR a versatile, programmable peripheral attached to any PC's bus.

There are two serial ports on the 8XC196KR, one is the standard SIO module found on the 8XC196KB, and the other is a Synchronous Serial I/O (SSIO) port. The SSIO is capable of full duplex synchronous communication. Both serial ports have their own programmable baud rate generators.

The 8XC196KR A/D converter is based on the 8XC196KC design but offers additional modes which allow programmable threshold detection and offset correction.

#### **8XC196KT**

The 8XC196KT is an enhanced version of the 8XC196KR with an optional 32 K byte OTPROM and has 1000 bytes of Register RAM and 512 bytes of Internal RAM. The 8XC196KT's bus controller has new modes which allow no wait state operation with slower external memory.

#### **8XC196NT**

The 8XC196NT is the same as the 8XC196KT but has 1M byte external addressability. Four of the A/D inputs were replaced with the Extended Address Port (EPORT). The four EPORT pins can be used as additional address lines (A16-A19) or standard low speed I/O's or a combination of both. The 8XC196NT has 20 MHz operation.

#### **8XC196NP**

The 8XC196NP is the first member of the MCS<sup>®</sup> 96 controller family with a dynamically selectable multiplexed/demultiplexed bus and low power operation (3.3 volts at 16MHz). Other key features of the 8XC196NP are the chip select unit, 1M byte addressing, 3 PWM outputs, and 25 MHz operation of 5 volts.

#### **8XC196NU**

The 8XC196NU is a footprint compatible upgrade to the 8XC196NP. It operates at 50 MHz and doubles the performance of the 8XC196NP. The 8XC196NU also has a demultiplexed address/data bus to make it easier to design low cost memory solutions. Other key features of the 8XC196NU are the chip select unit, 1M byte addressing, an Event Processor Array, and a Peripheral Transaction Server.

#### **Key Features**

- Up to 50 MHz Operation (NU only)
- 3.3 Volt Operation (NP only)

- Fast Register-to-Register Architecture
- Up to 1000 Bytes of Register RAM
- Up to 512 Bytes of Internal RAM
- Up to 32K of Internal OTPROM
- Up to 1M byte of External Addressing
- Dynamically Configurable 8- or 16-bit Buswidth
- Enhanced Bus Controller
- Dynamic Multiplexed/Demultiplexed Bus (NP and NU only)
- Chip Select Unit (NP and NU only)
- HOLD#, HLDA# Bus Protocol
- Up to 10 Channel Event Processor Array
- Two 16-bit Timer/Counters with Prescaler and Quadrature Counting Mode
- Full Duplex Serial Port with Independent Baud Rate Generator
- Full Duplex Synchronous Serial Port
- Slave Port for Direct Interprocessor Communication
- 16-bit Watchdog Timer
- Up to 8 Channel 8- or 10-bit A/D Converter
- IDLE and POWERDOWN Modes
- Peripheral Transaction Server
- 3 PWM Outputs (NP and NU only)

### **Motion Control Family**

*The motion control family includes the 8XC196MC, 8XC196MD and 8XC196MH.*

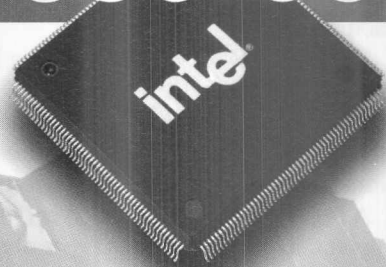
#### **8XC196MC**

The 8XC196MC is the first member of the MCS<sup>®</sup> 96 controller motion control family. This device has peripherals which are optimized for three-phase AC induction motor control and power inverter applications. The 8XC196MC is available in 16K byte ROM, 16 Kbyte OTPROM and ROMless versions. All versions feature 488 bytes of Register RAM.

The 8XC196MC has a unique peripheral, the Waveform Generator (WFG) which is used to generate a three-phase pulse-width modulation (PWM). The WFG generates three complementary non-overlapping PWM pulses with resolutions of 125 ns (edge trigger) or 250 ns (centered). The WFG features programmable frequency, duty cycle and dead times. The WFG has two programmable high drive capability outputs for each phase. The outputs have programmable polarity, or may be forced high or low. A protection circuit allows disabling of all outputs simultaneously in response to an external event.

The 8XC196MC has two hardware PWM generators. These have a common

# **BSO/TASKING 80C196**



## **The New Standard in C196 Tools.**

Highly optimized C compiler  
with Intel compatible  
assembler, linker and locator  
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programmable frequency, and separately programmable duty cycles.

The 8XC196MC uses the Event Processor Array (EPA) for event monitoring and control. There are 6 capture/compare modules, and 6 compare only modules. The EPA features 125 ns time resolution.

The 8XC196MC A/D converter is a 13 channel version of the 8XC196KRs. It operates in 8- or 10-bit mode, and has programmable sample and conversion times, threshold detect mode and offset correction.

A Peripheral Transaction Server (PTS) support microcoded interrupt processing requiring less CPU intervention. A special PTS mode supports the Serial I/O (SIO) function.

The 8XC196MC has a total of 53 I/O lines which are shared with the peripherals. Reduced pin-count packages are available for applications not requiring all the standard features.

#### **8XC196MD**

The 8XC196MD is the second member of the MCS<sup>®</sup> 96 controller motion control family. The 8XC196MD includes all of the 8XC196MC features, and adds

the following enhancements:

A frequency generator allows generating a programmable frequency square wave, which can be used in infrared remote control communications.

Two additional capture/compare and two compare only modules are added to the Event Processor Array, giving additional event capture and generation capabilities.

Eight additional I/O pins, two input only and one analog/digital input pin are added.

The 8XC196MD maintains pin-for-pin compatibility with the 8XC196MC device, allowing easy upgrades of existing designs.

#### **Key Features**

- Three Phase PWM Waveform Generator
- Frequency Generator (MD only)
- Up to 16 MHz Operation
- Fast Register-to-Register Architecture
- 488 Bytes Register RAM
- 16K Internal OTPROM/ROM
- Dynamically Configurable 8- or 16-bit Buswidth
- HOLD/HLDA Bus Protocol
- Up to 12 Channel Event Process Array (EPA)

- Two 16-bit Timer/Counters with Prescaler and Quadrature Counting Mode
- 16-Bit Watchdog Timer
- Up to Fourteen Channel 8- or 10-bit A/D Converter
- Up to Eight 8-bit I/O Ports
- IDLE and POWERDOWN Modes
- Peripheral Transaction Server (PTS)

#### **8XC196MH**

The 8XC196MH is the newest member of the MCS<sup>®</sup> 96 controller motion control family. It is designed primarily to control three-phase AC induction and DC brushless motors.

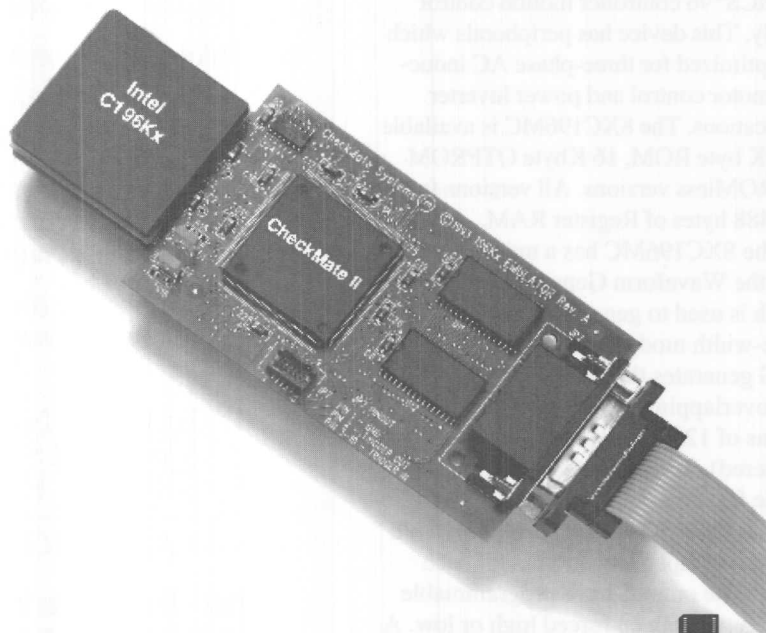
The 8XC196MH features an enhanced three-phase waveform generator specifically designed for use in "inverter" motor-control applications. This peripheral provides pulse-width modulation and three-phase sine wave generation with minimal CPU intervention. It generates three complementary non-overlapping PWM pulses with resolutions of 0.125  $\mu$ s (edge triggered) or 0.250  $\mu$ s (centered).

The 8XC196MH has two dedicated serial port peripherals, allowing less software overhead. The watchdog timer can be programmed with one of four time options.

#### **Key Features**

- Three Phase Complementary Waveform Generator
- Up to 16 MHz Operation
- Fast Register-to-Register Architecture
- 744 Bytes Register RAM
- 32K Internal OTPROM/ROM
- Dynamically Configurable 8- or 16-bit Buswidth
- Event Processor Array (EPA) with 2 High-speed Capture/Compare Modules and 4 High-speed Compare only Modules
- Two Programmable 16-bit Timers with Quadrature Counting Inputs
- 16-Bit Watchdog Timer
- Up to Eight Channel 8- or 10-bit A/D Converter
- Up to Fifty-two I/O Lines
- Two-Channel UART
- IDLE and POWERDOWN Modes
- Peripheral Transaction Server (PTS)

### **Get Your Engine Running.**

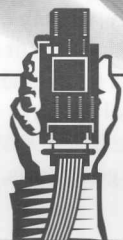


When Intel looked for 3rd party, C196Kx emulation tools to replace their own, they chose CheckMate. Because CheckMate is guaranteed to run in target, at 1/3 the cost of traditional box emulators. Discover how the leader in x86 support can get your 80C196Kx running! Call CheckMate Systems at 1-206-869-7211.



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## C 196 Tools

## The Total MCS<sup>®</sup> 96 Microcontroller Development Solution

- ▲ C compiler produces optimal code for the MCS<sup>®</sup> 96 microcontroller architecture
- ▲ Powerful assembler, linker/locator generates ROMable code
- ▲ ChipView<sup>®</sup>-196 with target ROM for debugging
- ▲ 100% Intel compatible
- ▲ Supports all MCS<sup>®</sup> 96 microcontroller derivatives
- ▲ C libraries and run-time support libraries
- ▲ SFRs provide direct access to peripherals
- ▲ In-line assembly programming
- ▲ Available on PC, and SUN and HP workstations
- ▲ Support hotline only a toll free call away

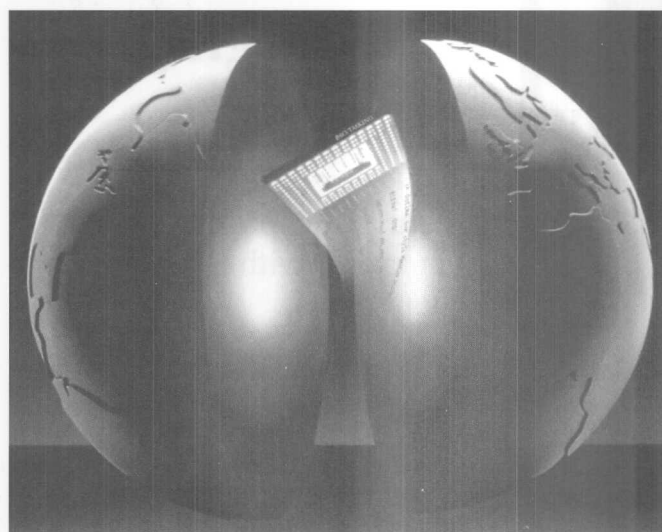
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TASKING Italy	Tel: +39 2 6698 2207
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- ▲ Compatible with your favorite emulator
- ▲ Compact, high performance kernel with 13 services, upgradeable to 67 power packed services
- ▲ Context sensitive help and on-line user manuals
- ▲ Embedded development environment lets users access all tools through a common Windows<sup>™</sup> interface

### Product Information

One supplier, one support hot line, one company... Established in 1974, BSO/TASKING pioneered the concept of cross development on mini computer systems. Today BSO/TASKING has 100 dedicated individuals who are focused on providing high quality solutions for the embedded systems developer across all computer platforms.

Customer satisfaction comes first at BSO/TASKING. We provide a toll free hot line for orders, asking technical questions, and reporting problems. Our products include a 90 day warranty. Comprehensive technical support can be continued by enrolling in our Maintenance Plan, which entitles you to all future releases including product updates and feature enhancements. Ask our competitors what they charged for their last update!



# ChipView®-196 Debugger

## The 196 Debugging Solution

- ▲ No learning curve, ChipView®-196 is keypress compatible with Borland's Turbo Debugger
- ▲ Execution environments include ROM monitor and simulator available soon
- ▲ Code in C, debug in C. Also supports assembly level debugging
- ▲ Displays C call stack and C data browsers with full variable data type and scope information
- ▲ Conditional breakpoints with pass counts and action selection
- ▲ One key 'edit' to switch to your editor fast. Total configuration save/restore after recompiling and reloading edited file
- ▲ Interfaces to any board running RISM
- ▲ Support hotline only a toll free call away

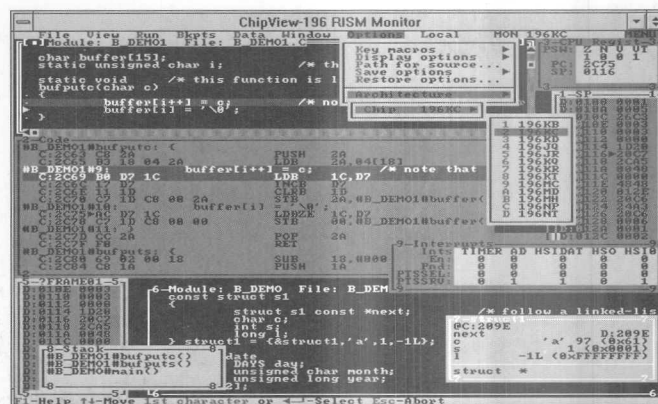
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### Product Information

BSO/TASKING supplies debuggers designed to deliver functionality that will reduce the time spent testing and debugging.

ChipView-196 not only displays your source code but uses the debug information that the C compiler generates, such as variable and function scoping and typing, including pointers, structures, enumerated types and arrays.

There are plenty of views to choose from: source level code, monitor, inspect, on-chip registers, call stack, variables, break point, execution trace. Multiple overlapping color windows can be moved and resized to suit you. Full screen zoom is only a mouse click away.

ChipView-196 interfaces directly to any evaluation or demo board running RISM. ChipView works with the i96KB RISM and RISMNT v1.0 running on target boards up to 115K baud. The ROM monitor supports the KB, KC, KD, JQ, KQ, KR, KT, MC, MD, MH and the NT and NP members of the MCS®96 microcontroller family.

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## Assembler 196

## The 196 Assembler from BSO/TASKING

- ▲ Assembler linker/locator generates ROMable, relocatable and reentrant code for optimum flexibility
- ▲ Intel OMF 96 object format generated with symbolic debugging information for ChipView®
- ▲ Intel compatible assembler and linker
- ▲ Powerful macro preprocessor language
- ▲ INST pin supported to allow ROM/RAM to overlap
- ▲ Support for all MCS® 96 microcontroller derivatives using special function register files
- ▲ Compatible with your favorite emulator
- ▲ Available on PC, and Unix Workstations
- ▲ Support hotline only a toll free call away

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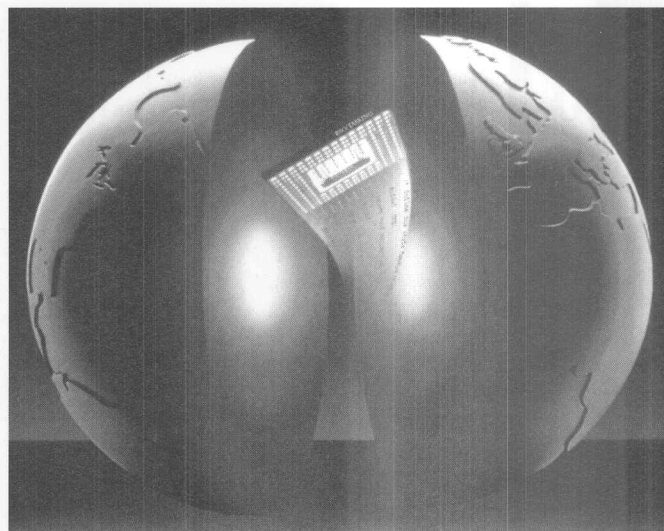
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- ▲ Many utilities included: make, library manager, object conversion utility
- ▲ Context sensitive help and on-line user manuals
- ▲ Embedded Development Environment lets users access all tools through a common Windows™ interface

### Product Information

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## ChipView®-196

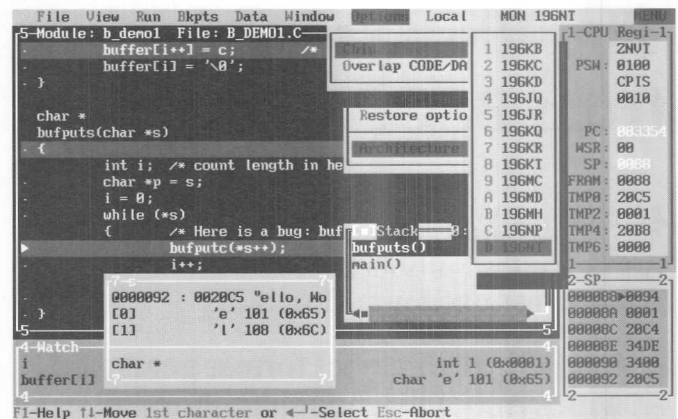
# ChipView®-196

## High-Level/Low-Level Debugger

- ▲ No learning curve
  - ChipView-196 is key-compatible with Borland's popular Turbo Debugger
- ▲ High-level support for C compilers, and assemblers from BSO/Tasking, IAR, Archimedes and Intel
- ▲ Point & click to toggle bkpts, or to watch or inspect C expressions with a mouse, menus or hot-keys
- ▲ C-Level debug displays C call stack and C data browsers with full variable data type & scope information
- ▲ Fully interactive VGA+ Windows™
  - Over 14 different views can be overlapped, moved, and resized
- ▲ One-key 'Build' launches the 'Edit-Recompile-Reload' loop and on return totally restores user's debug context
- ▲ 3 engines behind a common user interface support all phases of design & testing: High-Speed Simulator, Emulator, and ROM Monitor

### Contact Information

ChipTools, Inc.  
 1232 Stavebank Road  
 Mississauga, Ontario, Canada L5G 2V2  
 Tel: (905) 274-6244  
 Fax: (905) 891-2715  
 BBS: (905) 891-3095  
 Internet: chiptool@hookup.net



### Product Information

Turbo C programmers can move to debugging 80C196 embedded C instantly, as ChipView-196 is key-compatible with Borland's popular Turbo Debugger. It is available with a High-Performance Simulation engine, a ROM Monitor engine, or interfaced for popular 80C196 emulators.

ChipView-196 brings state-of-the-art debugging to all popular 80C196 C compilers at high-level. Unlike rudimentary debuggers that support only simple data types, ChipView-196 lets you browse through C structures, unions, enumerations, bit-fields, pointers and arrays. With ChipView-196 you can simply point & click your way along a linked list!

The ROM Monitor version interface directly to any evaluation board or DEMO board running RISM for the 80C196. Even under MS Windows™, ChipView-196 runs rock-stable at speeds up to 115K baud. ChipView-196 is the High-Level Debugger replacement for Intel's ECM host software.

### Support

- MS-DOS, OS/2, Windows 3.x, DesqView
- IBM AT or compatible with 3MB RAM
- Derivatives such as 8xC196Kx, 8xC196NT, 8xC196NP
- Custom version for popular emulators
- High-level support for C compilers from BSO/Tasking, IAR (Archimedes), and Intel—Source-level support for Assemblers for BSO/Tasking, IAR (Archimedes), and Intel.

### Warranty

All ChipTools products have a 30-day money-back guarantee, and one year of free updates and technical support to registered users.

### Ordering Information

CV196-S ChipView-196 High-Performance Simulator  
 CV196-M ChipView-196 RISM-based ROM Monitor  
 CV196-ISS ChipView-196 Instruction-Set Simulator  
 Call for a free working demo.

## Real-Time Executive in C

- ▲ Multitasking real-time kernel for the Intel MCS® 51 and MCS® 96 micro-controllers, and 80C186 embedded processors
- ▲ Deterministic design & implementation for low overhead & fast response
- ▲ Preemptive, time-sliced, & round-robin task scheduling with variable priority tasks
- ▲ Kernel services for task, memory, & resource management, intertask communication & synchronization, & timer support
- ▲ Synchronous or asynchronous intertask data movement via FIFO queues, mailboxes, & prioritized messages
- ▲ Fast, deterministic event synchronization with unique tri-state semaphore
- ▲ Partitioned memory management eliminates fragmentation
- ▲ Timeout capability on blocking actions
- ▲ Written primarily in ANSI C
- ▲ Configurable, ROMable, & user extensible
- ▲ System level debug facility, RTXC bug
- ▲ Integrated development packages with RTXC, C-Compilers, & RTXC - Aware Debuggers



### Product Information

RTXC is a multitasking real-time executive for use in embedded systems requiring a deterministic design with preemptive scheduling for true event-driven operation. Written primarily in ANSI C, RTXC is in wide use in telecommunications, factory automation and process control, office machines, medical and scientific instrumentation, avionics, and automotive applications. Since the introduction of RTXC in 1985, its success continues to be based on a robust library of services providing task, memory, and resource management; intertask communication and synchronization; and timer support. RTXC is available in three configurations; Basic Library, Advanced Library, or Extended Library. One-time site license fees are affordably low. There are no royalties, and all source code is included.

### Host Supported

- RTXC is independent of any particular development platform.
- Supports most C compilers.
- RTXCgen, the interactive system generation utility, runs on the development system. It is distributed with full C source so that it can be compiled to run on any development system with a native ANSI compatible C compiler.

### Technical Support

- 600 page user's manual.
- Binding manual specific to processor and C compiler.
- Full source code included in standard distribution.
- Direct factory support or support from experienced international distributors.
- Initial warranty period with option to extend to annual maintenance.
- Free updates and upgrades during warranty and maintenance periods.
- Free telephone consultation during warranty or extended maintenance periods.

### Contact Information

Embedded System Products, Inc.  
 11501 Chimney Rock  
 Houston, TX 77035-2900  
 Tel: (800) 525-4302  
 Tel: (713) 728-9688  
 Fax: (713) 728-1049

## 8096/196 Compiler

## 8096/196 Compiler

- ▲ Integrated development environment
- ▲ ANSI standard C Compiler
- ▲ Supports the entire K series
- ▲ Extended keywords specific for 8096/196
- ▲ Multiply memory models supporting single-chip to banked designs with up to 8MB of code
- ▲ Support for up to 32,768 external references
- ▲ Extended C library (80 + functions) with optimized floating point support
- ▲ Easy and fast interrupt handling directly in C
- ▲ Generates mixed C & assembly listings from the compiler and fully comprehensive cross reference map file after linkage

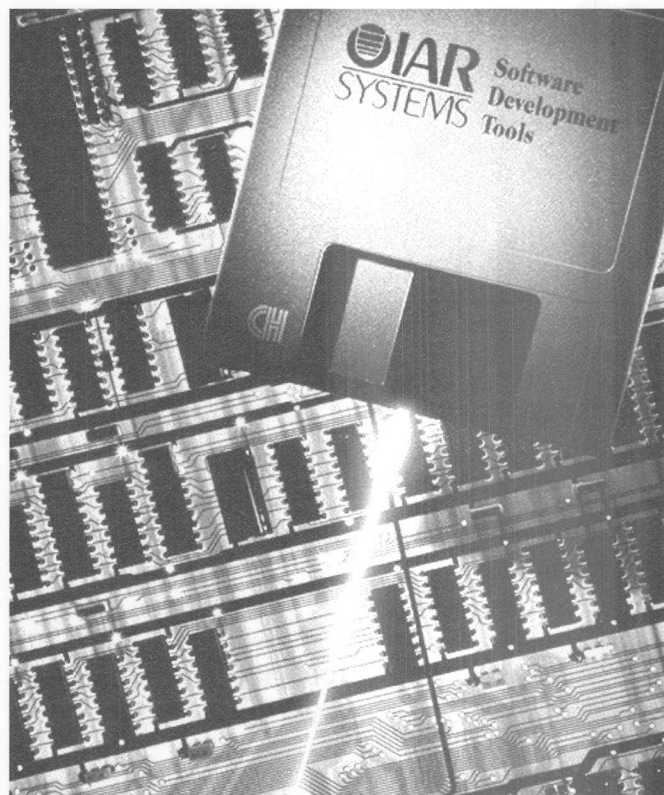
**Contact Information**

USA & Canada  
IAR Systems Software, Inc.  
One Maritime Plaza  
San Francisco, CA 94111  
Tel: (415) 765-5500  
Fax: (415) 765-5503

United Kingdom  
Tel: +44 71 924 3334  
Fax: +44 71 924 5341

Sweden  
IAR Systems AB  
P.O. Box 23051  
S-750 23 Uppsala  
Tel: +46 18 16 78 00  
Fax: +46 18 16 78 38

Germany  
Tel: +49 89 470 6022  
Fax: +49 89 470 9565

**IAR 8096/196 Compiler**

IAR's 8096/196 kit comes with IAR's optimized C compiler, relocatable macro-assembler, universal linker XLINK, librarian XLIB, ASCII editor, Make utility and a friendly user interface.

**Macro Assembler**

The IAR 8096 package comes with a relocatable macro assembler for time-critical routines. Interfacing between C and assembly is straight forward. It allows you to use relocatable as well as absolute code segments.

**Linker and Librarian**

The linker XLINK supports complete linking, relocation and format generation to produce PROMable code. XLINK generates over 32 different formats and is compatible with most popular emulators. The librarian XLIB allows you to create and maintain relocatable libraries that get loaded only if they're called.

**User Interface**

A friendly user interface is part of the IAR 8096 development kit. It includes an error sensitive editor and a Make utility. You can create projects, edit files, compile, assemble, link and build all within the same interface.

**Host Systems Supported**

IBM PC & compatible (80386 or above); SUN 4 (SPARC); HP 9000 series 700.



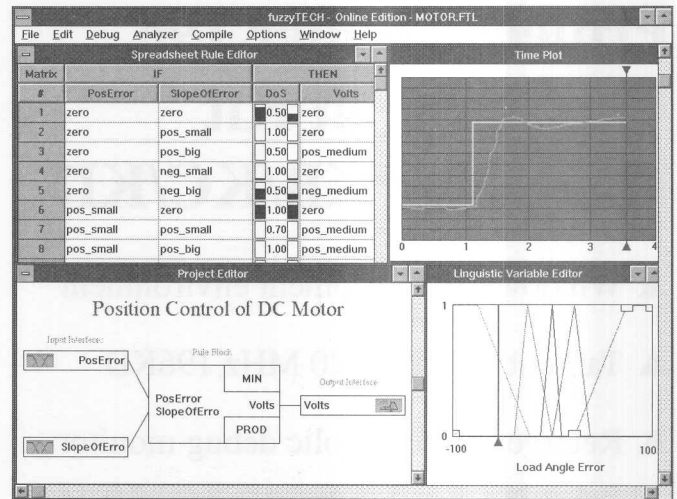
# fuzzyTECH

## Fuzzy Logic Development System

- ▲ Integrates fuzzy logic in every embedded design
- ▲ Includes all graphic design tools
- ▲ Provides various graphical simulator features and analyzer tools
- ▲ Allows learning of fuzzy rules from data sets using NeuroFuzzy Technologies
- ▲ Provides online technology for optimization "on-the-fly"
- ▲ Generates ANSI C code with various optimizing options
- ▲ Generates assembly code for MCS<sup>®</sup> 96 & MCS<sup>®</sup> 51 microcontroller families
- ▲ Visual Development under MS-Windows<sup>™</sup> 3.1 or later
- ▲ Includes full engineering and design support by Inform's project teams

### Contact Information

Inform Software Corporation  
2001 Midwest Road  
Oak Brook, IL 60521  
Tel: (708) 268-7550  
Fax: (708) 268-7554



### Product Information

FUZZY LOGIC is a technology that enhances model-based system designs using both intuition and engineering expertise. This technology empowers products with new, innovative functions. Fuzzy Logic allows for a representation of desired system behavior using elements of everyday language, thus circumventing the need for rigorous mathematical modeling.

FUZZY LOGIC can be fast even on standard microcontrollers using fuzzyTECH<sup>®</sup>. A fuzzy logic system consisting of 20 rules computes in less than 0.33 ms on an 80196/20 MHz, taking only 0.69 KB of ROM. Even with an 8051/12 MHz, this system can be computed in less than 1.9 ms using 0.54 KB of ROM.

NEUROFUZZY Technologies inside fuzzyTECH<sup>®</sup> enable automatic learning of fuzzy logic rule bases from sample data sets.

The fuzzyTECH<sup>®</sup> software workbench lets you design, simulate and optimize a fuzzy logic system graphically without seeing a single line of code. Various graphical analyzer tools assist you in debugging your fuzzy logic system. The fuzzyTECH<sup>®</sup> RTRCD add-on module features fuzzy control strategies to be developed and optimized in real time on a running system from a PC. Inform also offers engineering support and consulting.

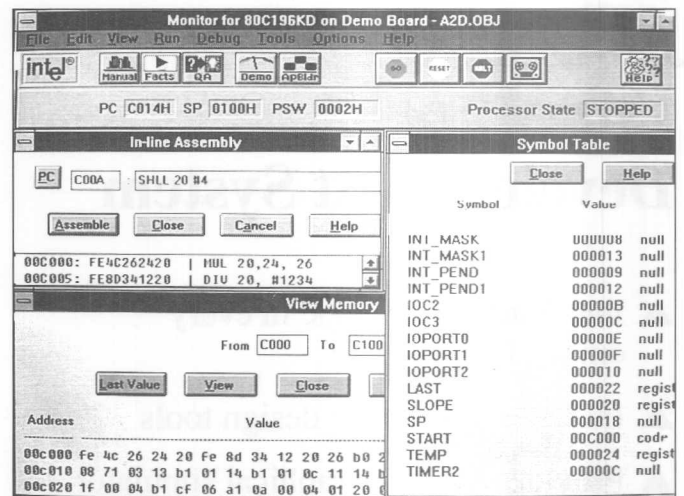
## Project Builder 196

# Project Builder 196 Development Kit for the 196KB/KC/KD

- ▲ Windows™ development environment
- ▲ Target board with 20 MHz 196KD
- ▲ Retargetable symbolic debug monitor
- ▲ Limited Assembler & C Compiler
- ▲ ApBUILDER programming tool
- ▲ Application modeling software
- ▲ Configurable "Make" utility
- ▲ Hypertext technical manuals
- ▲ CAD schematics & library
- ▲ Timing analysis S/W & library
- ▲ At a reasonable price of: \$196.00

## Ordering Information

Call Your Local Intel Distributor  
 Order Code: PROJBLD196KBCD  
 Also available with fuzzy logic S/W!  
 See fuzzyBUILDER Kits  
 For FREE Demo Software call Intel Literature:  
 U.S. & Canada: 800 468-8118  
 U.S. Literature Order No. 272329  
 Non U.S.: Call Local Intel Sales Office



Retargetable Symbolic Debug Monitor

## Product Information

Project Builder 196 is a low cost kit that answers the Design Engineer's question: "How well does the Intel 196 Embedded Controller handle my application?". The *ModeBUILDER* software allows you to create a system level model of your application without writing a line of code! Use your mouse to select any of 9 configurable performance templates. For a highly refined performance analysis, load one module of your own application code into *ModeBUILDER*, and combine it with your application model. Use the model to explore H/W design "what if" scenarios with pull down menus and screen buttons to change memory wait states, address bus width and CPU frequency.

When you begin your application use *ApBUILDER*, a powerful system expert programmers tool for Intel's embedded controllers. It generates both 'C' & ASM code while mapping everything programmers need to each development screen. Programming masks prevent mistakes. You can develop an application without prior knowledge of the MCS®96 architecture.

Download your programs from your PC serial port at 57.6K baud to the target board for real time savings! The board has a 20 MHz 196KD embedded controller and can operate as a stand alone system. Program your application into FLASH or EPROM and use the board interface connectors for high speed input/output interface, analog inputs, digital inputs/outputs and external memory. The symbolic debug monitor can also be retargeted to your design prototype. The monitor kernel is configurable for Intel's 196KB, KC and KD *at any processor speed!*

## System Requirements

PC with DOS & Windows™ 3.1 or higher RAM: Minimum to run Windows, 2MB or above.

## Fuzzy Logic Development S/W for Project Builder Kits

- ▲ Windows™ development environment
- ▲ CASE tools create system code in ASM highly optimized for Intel MCS® 51, MCS® 251 and MCS® 96 microcontroller architectures
- ▲ S/W designed for use with Intel's Project Builder Kits for turnkey H/W & S/W project development
- ▲ Interface fuzzy system code to board with ApBUILDER code generation tool
- ▲ S/W starts at only: \$180.51

### Ordering Information

Call Your Local Intel Distributor

Order Codes:

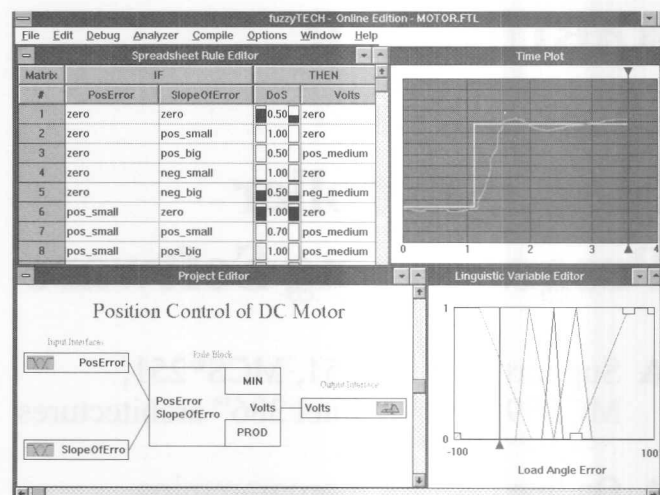
FUZZYTECHEXP96	\$196.00
FUZZYTECHEXP51	\$180.51
FUZZYTECHMCU96	\$1896.00
FUZZYTECHMCU51	\$1802.51
FUZZYRTXDEBUG96	\$2796.00
FUZZYRTXDEBUG51	\$1851.00
NEURALFUZZYMOD	\$900.00

Intel Literature:

U.S. & Canada: (800) 468-8118

U.S. Literature Order No. 272340

Non U.S.: Call Local Intel Sales Office



### Product Information

#### fuzzyTECH MCU-XX Edition

A total graphic development environment for fuzzy applications which support extremely large number of design rules for fuzzy systems. Generates highly optimized C code with ASM calls.

#### fuzzyTECH MCU-XX Explorer

A small system and training version of MCU-XX with simulated system. Input up to 125 rules. Generates highly optimized C with ASM calls.

**Real-Time Remote Cross Debugger** for MCU-96 and MCU-51 Development S/W. Optimize and debug your running system in Real Time with graphical output displays on your PC. Recompile the entire system on the fly without halting the running target application.

**NeuroFuzzy Module** for all MCU-XX Editions, learns from input and output data and writes fuzzy logic rules. Rules can be locked while the module learns the rest. Use the learning algorithms in the module or program your own for total flexibility.

### System Requirements

PC with DOS & Windows™ 3.1 or higher. RAM: Minimum to run Windows, 2MB or above.

# ApBUILDER

## Interactive Microcontroller Programming Software

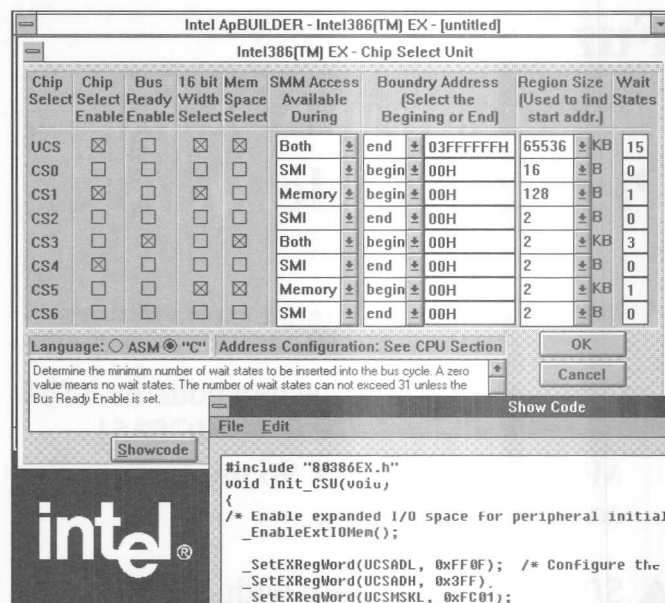
- ▲ Support for MCS® 51, MCS® 251, MCS® 96, 186 & Intel 386™ architectures
- ▲ On line peripheral programming
- ▲ Context sensitive access to hypertext manuals
- ▲ On line data sheets and fact sheets
- ▲ Windows™ interface for ease of use
- ▲ Assembly instruction syntax editor
- ▲ Common Q & A support
- ▲ And...it's **FREE** from Intel's BBS

### Contact Information

Intel Corporation  
2200 Mission College Blvd.  
Santa Clara, CA 95052-8119  
Tel: (800) 628-8686  
FaxBack: (800) 628-2283

### Ordering Information

ApBUILDER and all hypertext manuals may be downloaded 24 hrs a day from Intel's Bulletin Board System (BBS):  
U.S. BBS #(916) 356-3600 Europe BBS #044-793-496340  
From the Worldwide Web [URL: <http://www.intel.com/>]



### Become an Architectural Wizard Instantly

ApBUILDER is a powerful new design tool for the embedded control applications programmer. This product was created specifically to speed up your learning curve and reduce your total design time, no matter what level of processor experience you have. ApBUILDER software provides you with peripheral design capabilities, an interactive instruction and register editor, a click-on highlight feature, and access to hypertext hardware reference manuals.

The ApBUILDER programming software saves you time and energy by providing a simple mechanism for configuring an embedded processor. And it's flexible, too. It has a design section that allows you to select the functionality of each integrated peripheral. If you want to program a specific register, ApBUILDER software provides the on line capability of picking and choosing the bits you want to set within the register itself. In both cases, ApBUILDER software converts your selection into 'C' or assembly language code.

ApBUILDER's block diagram screens give a graphic overview of the unique features of a selected device. By giving you the ability to view multiple products quickly and easily, ApBUILDER software also becomes a valuable tool in helping you choose which processor is best suited for your application.

Context sensitive access to hypertext documents are organized throughout the ApBUILDER software, enabling you to access an extraordinary amount of data quickly and easily. With the click of a button, you have access to hardware reference manuals, data sheets, fact sheets, answers to commonly asked questions, and general help information. ApBUILDER enables you to focus on your application rather than wasting time programming bit by bit.

### Personal Computer Requirements

Requires an IBM or BIOS-compatible 80386 PC or above, a VGA monitor, 4M byte hard disk, 1.44M byte floppy-disk drive, 4M bytes RAM, mouse, Windows™ 3.1 or later.



# Special Support Package for the Intel 87C196-JR

Includes:

**FIREMAN8X**

**MultiprogrammerTC8196-JR**

**Programs, Verifies & Sumchecks 8**

**devices in 10 seconds**

**Introductory offer \$1495**

## BYTEK MultiProgrammer

Features:

- ▲ 25 Key & 40 Character LCD
- ▲ RS232 Serial Port
- ▲ DB25 Parallel Port
- ▲ 2 Megabit Ram  
(expandable to 128M Bit)
- ▲ Fast programming time  
(Prog./Ver. 1M Bit EPROM in 18 Sec.)
- ▲ Gang 8 Micros
- ▲ Gang/Set 8 EPROMS/FLASH
- ▲ Versatile-Optional TRKCEL:  
– (E)EPROMS, FLASH, Micros
- ▲ Package Support for:  
– DIP, PLCC, SOIC, PSOP  
– TSOP, PQFP, and others
- ▲ Stand-Alone Operations  
Edit, Load, Verify, Blank, Check, Program

### Contact Information

BYTEK Corporation

543 NW 77th Street Boca Raton, FL 33487

Tel: (407) 994-3520

Fax: (407) 994-3615



## BYTEK EZ-WRITER XT MULTI PROGRAMMER®

- 25 Keys and 40 character LCD
- Memory from 2M bit to 32M bit
- 32-pin DIP socket supports 24-, 28-, and 32-pin E/EPROMs including flash
- 40-pin DIP socket supports 40-pin, 16-bit-wide EPROMs
- Also support for 32 PLCC
- Standard RS232C and parallel port.

Optional  
TRKCELS

Available

Part Number EZ-FT/2

Each \$795.00



## BYTEK FIREMAN 8X PROGRAMMER®

- 25 Keys and 40 character LCD
- Memory from 2M bit to 32M bit
- Eight 32-pin DIP socket supports 24-, 28-, and 32-pin E/EPROMs including flash
- Standard RS232C and parallel port.

Optional  
TRKCELS

Available

Part Number FIREMAN- 8X

Each \$895.00



## BYTEK MULTI PROGRAMMER®

The MTKX2000XD supports 2/4 tracks. Each track (TRKCEL) supports 8 sockets (max 32 skts) to program different technologies and/or package types.

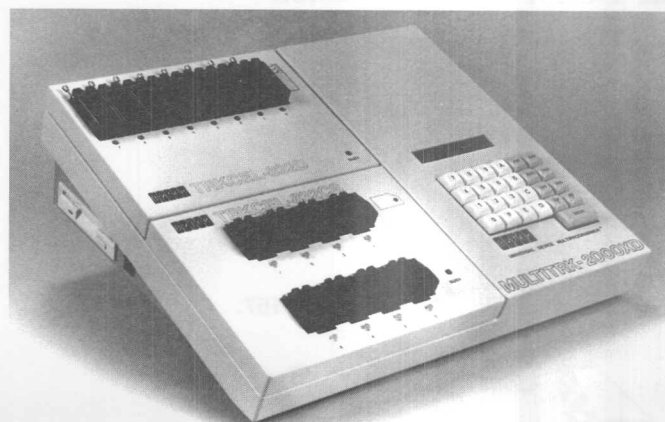
- 25 Keys and 40 character alphanumeric LCD
- 8Mbit on-board RAM expandable to 64Mbit
- Gang duplicator (duplicates up to 16 devices)
- Set programmer supports 8-, 16-, and 32-bit-wide
- Standard RS232C and parallel port
- 3.5" disk drive allows easy device updates.

Requires

Optional  
TRKCELS

Part Number MTKX2000XD

Each \$1495.00



## CheckMate II-C196K™

# CheckMate II-C196K™ Emulator

- ▲ 16 MHz standard/20 MHz optional operation to support KB, KC, and KD targets
- ▲ Patented emulator technology
- ▲ 10M bits per second communication speed
- ▲ Plug-in and run operation; fully supports Intel's ONCE mode in ROM and ROM-less targets
- ▲ Does not use target ADDRESS or I/O space, target interrupts or stack space
- ▲ ChipView® Windowed Source Level Debug interface standard
- ▲ Complete hardware event system has 4 groups with 32 ADDR, 16 DATA, STATUS (including DMA and interrupt acknowledge), 16-bit event counter, and 8 external Logic State Inputs (LSI)
- ▲ 16K trace memory standard (256K optional) qualified by hardware event system. Includes LSI and Timestamp
- ▲ 128K overlay memory standard
- ▲ Supports bank switch via INST pin
- ▲ PC/AT or above hosted
- ▲ ISA/Microchannel/PCMCIA Bus support

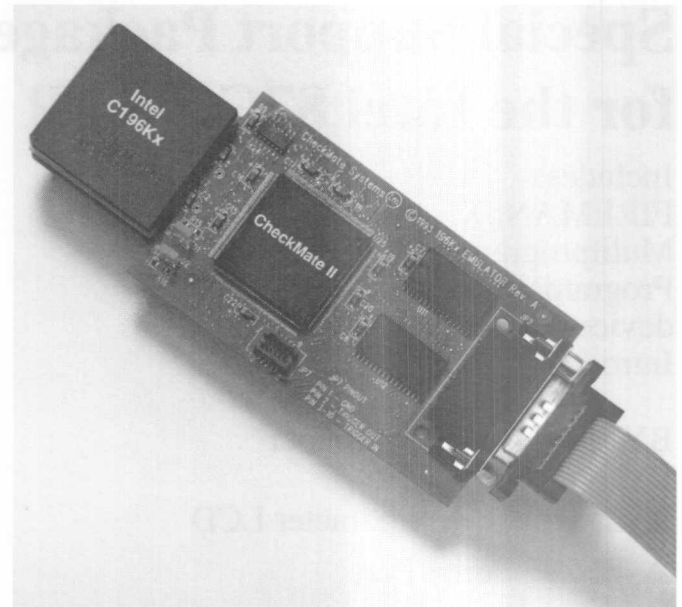
## Contact Information

CheckMate Systems  
8581 154th Ave. NE  
Redmond, WA 98052  
Tel: (206) 869-7211  
Fax: (206) 861-3647

For International contacts see page 157.



**CheckMate Systems™**



## Source Level Debug Environment

CheckMate-C196K™ comes complete with our own, windowed source level debugger interface. Our entire emulator feature set is available directly in the debug environment. Of course, this means that CheckMate-C196K™ is compatible with all code generated from any languages that output OMF-96, and IAR.

## Rich Feature Set

### Hardware Bus Event System and Breakpoints

The Hardware Bus Event System consists of 4 groups or levels each containing 8 ADDRESS, 4 DATA, and STATUS comparators coupled to 8 LSI external trigger inputs and a 16-bit hardware event counter.

The actions available are to break evaluation, jump forward or backward to another Group, Trace on/off or Single Cycle, Increment/Reset counter or Trigger out.

In addition, an unlimited number of ADDRESS only Execution Breakpoints are available.

### Trace Memory

The 16K trace buffer captures all ADDR, DATA, STATUS information, along with a 16-bit timestamp and the 8-bits of Logic State Inputs (LSI). Trace is fully qualified by the Bus Event System and it can also PRE, POST, and CENTER trigger.

256K trace buffer is optional.

### Overlay RAM

Overlay memory comes standard with 128K Bytes and it may be mapped in any combination of internal ROM or external memory. This memory is 0 wait-state at 16 MHz target clock operation.

### Ordering Information

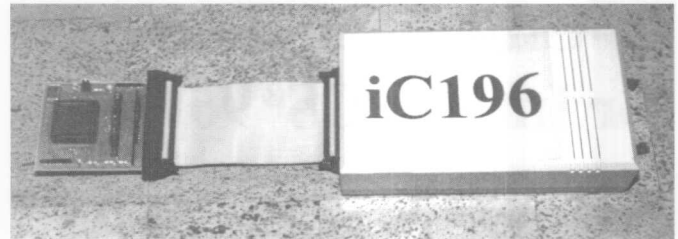
Contact factory for pricing.

## iC196 Power-Emulator for the 80C196 family

- ▲ Wide range of 80C196 family support
- ▲ Integrated Development Environment
- ▲ Real-time emulation up to 16 MHz
- ▲ Overlay memory up to 128K bytes
- ▲ Mapping resolution 128 byte
- ▲ HW-Breakpoints up to 128K
- ▲ Three pass counters for code breakpoints
- ▲ Three pass counters for data breakpoints
- ▲ Conditional data and code breakpoints
- ▲ Backstep on source level
- ▲ Powerful trace 16K 40-bit
- ▲ Clock source internal/external
- ▲ Watch and dump window
- ▲ Performance analyzer
- ▲ SAA user interface
- ▲ High speed PC link

### Contact Information

iSYSTEM GmbH  
Einsteinstr. 5 - D-85221 Dachau - Germany  
Tel: +49(8131)25083  
Fax: +49(8131)14024  
Modem: +49(8131)1687  
ISDN: +49(8131)53502  
CompuServe: 100020,470



### Product Information

The iC196 In-Circuit Emulator is a high performance real-time development system supporting the 80C196 microcontroller family. It provides an optimized, integrated environment for hard and software development to shorten development cycle and to increase productivity dramatically.

The Integrated Development Environment (IDE) is based on the SAA-Standard and runs under DOS and Windows™. It includes a project manager, a multi-file C source color editor and a high-level source debugger.

The flexible interface to third party compilers, assemblers and linkers gives the possibility to run these tools automatically from inside the IDE using the powerful MAKE and BUILD functions. All options for these tools can be set from within a dialog box.

The perfect combination and integration of all development tools in one powerful environment speeds up the development cycle extremely.

iC196 with the powerful Trace, the Profiler and the backstep on source are the right tools to get your product in-time to the market, to optimize the performance and to secure the quality of your application.

### Processors Supported

C196 is currently supporting the following members of the 80C196 microcontroller family:  
80C196KB, 80C196KC, 80C196KD, 87C196KB, 87C196KC, 87C196KD, 80C196KR, 80C196KT, 80C196MC.

We add support for new chips continuously.

Please contact your iC196 vendor for latest information.

### Host Systems Supported

PC Platform

### Ordering Information

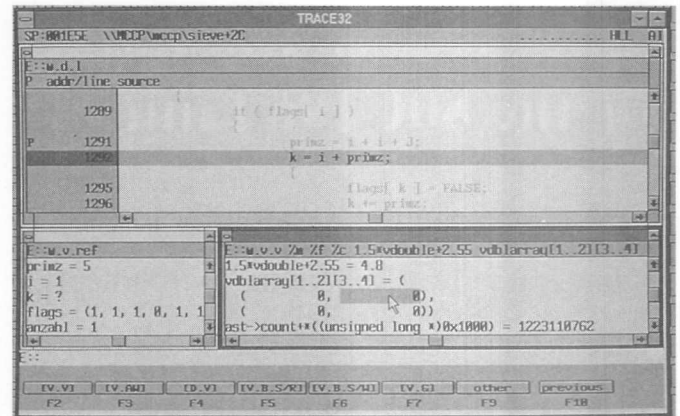
C196 starts at \$3,100. US. Please contact our head office to get the address of our distributor in your country. Complete info package and demo diskette are available for free. You can download the latest demo software, technical and pricing information or latest software updates and manuals from our BBS. You can access our BBS via Modem or ISDN.

## In-Circuit Emulator for Intel MCS® 96 Microcontroller

- ▲ Universal In-Circuit Emulator for 8 to 32-bit microprocessors
- ▲ Unlimited hardware breakpoints
- ▲ Up to 16M Byte dual-ported emulation memory
- ▲ High-speed link via Ethernet LAN or fiber optic
- ▲ Up to 4M frame trace buffer
- ▲ Real-time trace and trigger
- ▲ Integrated high-level language debugger supports: Intel, IAR, & BSO/Tasking
- ▲ Multi-task debugger
- ▲ Performance analysis and statistic functions
- ▲ Available for PC, SUN, DEC, VAX, HP workstations
- ▲ Support for 196KB, 196KC, 196KD, and 198
- ▲ We also support the following Intel architectures: MCS® 51, 80C186, and 80386/486 microcontrollers & microprocessors
- ▲ Timing-analyzer with pattern generator and line tester



LAUTERBACH  
DATENTECHNIK



### Product Information

The TRACE32 provides a complete set of development and testing tools. The advanced modularity of TRACE32 makes it very easy to upgrade the system to future needs. By adding or changing personality modules another microprocessor or a new feature can be supported.

The TRACE32 has more interfaces to PCs and workstations than any other system. The communication link to the host is done by the fiber optic interface or Ethernet allowing a high-speed transfer. Other standard interfaces such as SCSI, RS-232, RS-422 and a low cost parallel connection are also supported. Software drivers are available for most systems, so it is possible to share a TRACE32 in a LAN of PCs and workstations.

The integrated HLL- Debugger with its powerful trigger and trace capabilities supports multi-task kernels as well as real-time systems. Interrupts can be served at any time during single-step emulation (Ada, C, C++, Modula 2, Pascal, PL/M and assembly languages supported).

The analyzer offers selective state trace as well as software performance analysis and statistic functions.

The comfortable windowed user interface is completely configurable by the user, no system offers more flexibility. With its powerful printer interface hardcopies of windows or screens can be made in text or graphic form which are best suited for technical documentation.

The testing language PRACTICE-II with its macro concept can be used for automatic hardware and software test routines.

### Contact Information

Lauterbach Datentechnik GmbH  
Fichtenstr. 27  
D-85649 Hofolding, Germany  
Tel: (08104) 8943-0  
Fax: (08104) 8943-49

Lauterbach Inc.  
945 Concord Street  
Framingham, MA 01701 USA  
Tel: (508) 620-4521  
Fax: (508) 620-4522



## EMUL196-PC

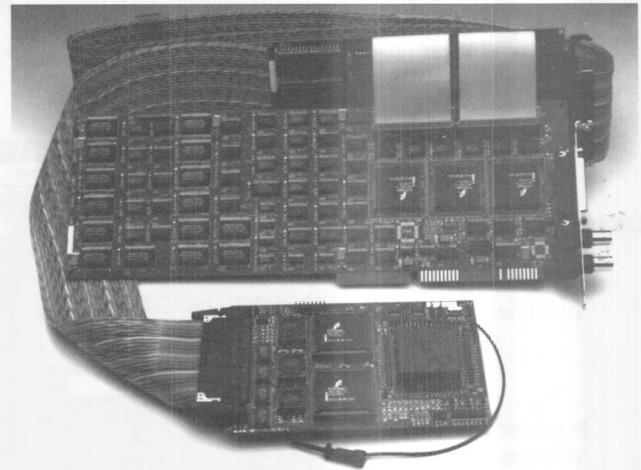
## EMUL196-PC

- ▲ Support for 80C196: KB, KC, KD, KQ, KR, KS, KT, JQ, JR, JT, NP, NU
- ▲ Real-time emulation at maximum chip speeds
- ▲ Use of bond-out chips for accurate emulation
- ▲ Hosted on PC's and Workstations
- ▲ High level support for popular C compilers
- ▲ Unlimited hardware breakpoints
- ▲ Break in real-time on Internal Access, both on data value and address
- ▲ Trace board up to 512K deep, 104-bits wide, with 40-bit timestamp. Triggering and filtering with full instruction queue decoding
- ▲ Memory contents shown during real-time emulation (Shadow RAM)
- ▲ Code Coverage and Program Performance Analysis
- ▲ CCB's Controlled from user interface, (Wait states, timing mode, bus width and more)
- ▲ Low cost version available

To learn more, please call (408) 866-1820 for a FREE Demo Disk.

Please see our ad on the inside front cover.

**NOHAU**  
CORPORATION



#### Product Information

The EMUL196-PC hardware is based on PC plug-in boards. The emulator board connects to one of several pod boards through a 5 foot long ribbon cable. The trace board connects to the emulator board through two ribbon cables on top of the two boards. (See picture above.)

An important part of an emulator system is the physical connection to your target board. Nohau provides several adapters that go between the pod board and the target board. Please refer to a current price list for details.

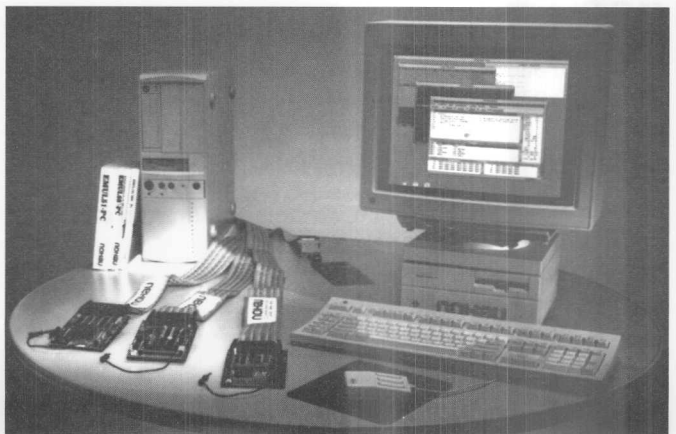
The pod boards are designed around Intel's "bond-out" chips, which are special emulation parts made for in depth emulation. The basic pods are designed to support the chip in external mode only. For single chip mode emulation a "port replacement module" is available. This unit sits between the pod and the adapter. Please refer to a current price list for details.

#### Low Cost 80C196 Emulator Available

This version of the EMUL196-PC consists of a pod board and a small plug-in board. The two boards are joined with a five foot cable. A PCMCIA card for use with laptops is offered as an alternative to the plug-in board. This solution does not support trace and Shadow RAM.

#### Workstation Configuration

All of Nohau's emulators can be used on Workstations like Sun and HP. The emulator then becomes part of Nohau's LanICE configuration which hooks up to an X-station over a standard Ethernet network.

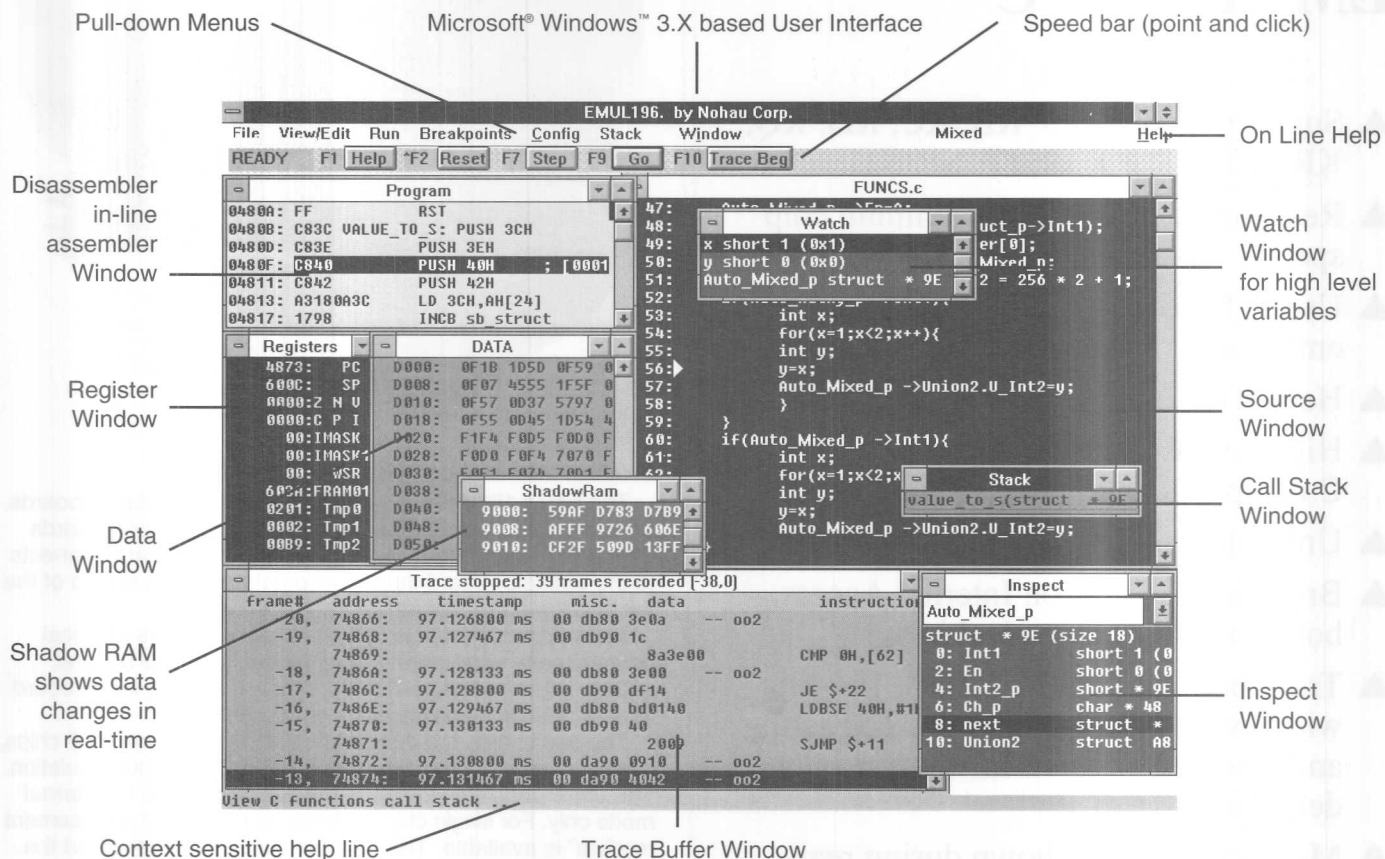


(continued)

## EMUL196-PC

(continued)

## 80C196



## Contact Information

Nohau Corporation  
51 E. Campbell Ave.  
Campbell, CA 95008  
Tel: (408) 866-1820  
Fax: (408) 378-7869

See page 165 for Nohau's representative in your area

See our ad on the inside front cover for information on our 8051 in-circuit emulators.

**NOHAU**  
CORPORATION

## Product Information

One of the key features of the EMUL196-PC is its user-friendly MS Windows™ interface. Pull-down menus, mouse support, and on-line help make infrequent users feel instantly at home. More experienced users will appreciate the easy to use hot keys.

The EMUL196-PC is designed to save you debugging time. Therefore, all information regarding the microcontroller and your application software is available right on the screen. Windows gives flexibility to size and position the information on the screen. Of course, all setup information can be saved to a file enabling you to start an emulation session quickly with the setup you had when you left it. This includes the CCB's.

All commands are supported with on-line help information.

(continued)

## EMUL196-PC

(continued)

# EMUL196-PC

## System Specifications

### Supported 80C196 Derivatives

- 80C196KC, KD, KR, KS, KQ, KT, JR, JQ, JT, NT, NP, NU and more

### Hosts

- 386 or better computer.
- Sun, HP and other workstations with LanICE.

### High-Level Debugging

- Window for source-level debugging.
- Single Step or Line Step with breakpoints marked directly in the code.
- Full support of local and global variables.
- Currently support Intel OMF, Intel Extended OMF BSO/Tasking and more.

### Symbolic Support

- Full symbolic debugging with type information.
- Same symbols can be used in different modules.
- All special functions registers supported.

### Real-Time Emulation

- Full-speed emulation up to the chip's limit.
- No wait states and no intrusion on memory, I/O or interrupt pins.

### In-Line Assembler and Disassembler

### Emulation Memory

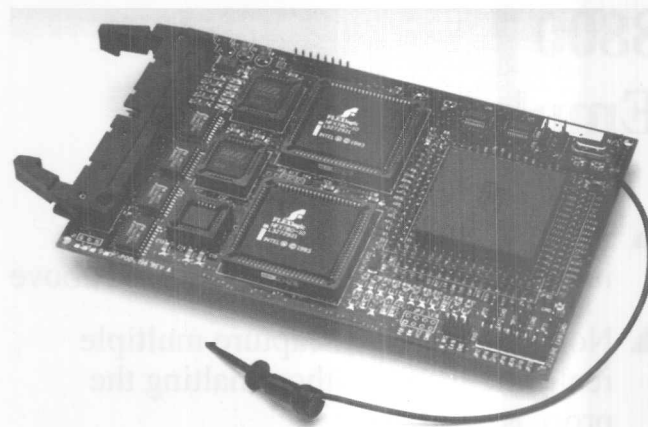
- 64K DATA memory and 64K CODE memory using 16-bits address.
- 256K memory if using 24-bits address.

### Contact Information

Nohau Corporation  
51 E. Campbell Ave.  
Campbell, CA 95008  
Tel: (408) 866-1820  
Fax: (408) 378-7869

See page 165 for Nohau's representative in your area  
See our ad on the inside front cover.

**NOHAU**  
CORPORATION



### Memory Mapping

Mappable down to even byte.

### Breakpoints

- Hardware and Software breakpoints.
- Unlimited program breakpoints.
- Break on internal access on address and/or data.
- With the trace board option, it's possible to break on any Address, Data or External signals.

### Single Stepping

- Single or multiple instruction stepping.
- Step over calls and interrupts.
- Line Stepping in high-level languages.

### Real-Time Trace

- Up to 512K deep, 104-bits wide, with time stamp.
- Three trigger levels, trigger on address and data.
- Instruction queue decoding prevents false triggers.

A centering counter allows positioning of the trigger point anywhere in the trace buffer. This allows you to trace before and after, or around the trigger.

The trace can be operated "on-the-fly", which means that it can be viewed, programmed and retrigged without disturbing program execution.

The code coverage feature can monitor up to 1MB of addresses. The specified addresses do not have to be continuous. All accesses, including data and opcode prefetches, can be captured.

## 8800

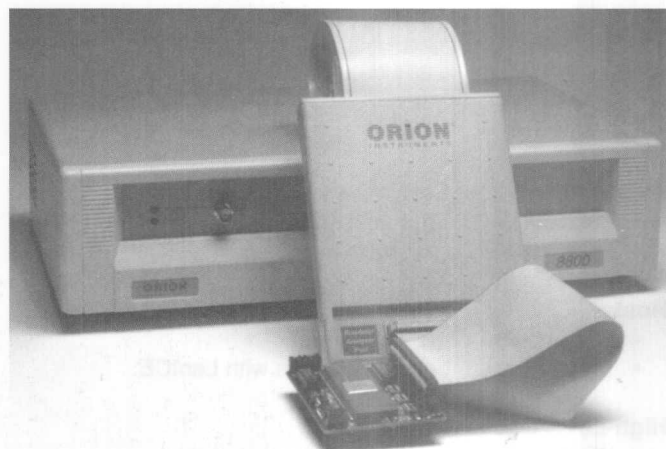
## Emulator/Analyzer

- ▲ Full speed, zero-wait-state, non-intrusive operation to 25 MHz and above
- ▲ Non-stop analysis: capture multiple real-time traces without halting the processor
- ▲ Sophisticated, multi-level triggering for precise trace capture and filtering
- ▲ Patent-pending Clip-On Emulation™ for soldered-in processors
- ▲ Up to 2M bytes overlay memory
- ▲ Ultra-fast parallel interface to PC downloads 128K file in under 2 sec
- ▲ 65,535 hardware breakpoints, 256 software breakpoints
- ▲ High-level language/symbolic debug support
- ▲ Real-time performance analysis
- ▲ Complete language subsystem for sophisticated macros

**Contact Information**

Orion Instruments  
 1376 Borregas Avenue  
 Sunnyvale, CA 94089  
 Tel: (800) 729-7700  
 Tel: (408) 747-0440  
 Fax: (408) 747-0688  
 Ask for Corporate Sales

**ORION**  
 INSTRUMENTS

**Product Information**

Orion's PC-based 8800 Emulator/Analyzer is a high performance development system providing robust, zero-wait-state support for a wide range of MCS®96 microcontroller members. With up to 2M bytes overlay memory, a deep "non-intrusive" trace, surface mount support, fast parallel downloads, and a powerful user interface, the 8800 offers a superior combination of features for development of MCS®96 microcontroller hardware and software.

Thanks to its advanced hybrid emulator design, the 8800 minimizes target loading and signal delays, providing the ultimate in operational transparency. In addition, the 8800 provides non-stop analysis of your program, letting you set and reset trigger conditions "on-the-fly" and capture multiple traces without halting your target with breakpoints. These real-time traces show all processor bus cycles and include symbols and interleaved C source. A smart disassembler handles the 80C196's pre-fetch queue.

The 8800's unique Clip-On Emulation™ probing scheme is the best solution for soldered-in 80C196 designs. Unlike ONCE mode, Clip-On does not tri-state the target processor. By connecting directly to surface mount processors in their normal state, the 8800 is ideal for debugging both prototype and production boards.

Symbolic debug and high-level language support are standard. The 8800 accepts the symbolic debug output from Intel's compilers and assemblers as well as from other third-party suppliers. A special "run-external" feature lets you hot key out to your editor or compiler and hot key back into the 8800 environment without disturbing emulation.

A complete language subsystem lets you create powerful macros easily. With full support for looping and branching, power users can create automated test suites for thorough program performance and board checkout.

**Processors Supported**

80C196KB/KC/KD, 80C196KR/KQ, 80C196KT, 80C196NT. Call for availability on other MCS®96 microcontroller family members.

**Host Systems Supported**

80386 or higher PC compatibles.



## USP-96, USE-96NT

## MCS<sup>®</sup> 96 Microcontroller In-Circuit Emulator

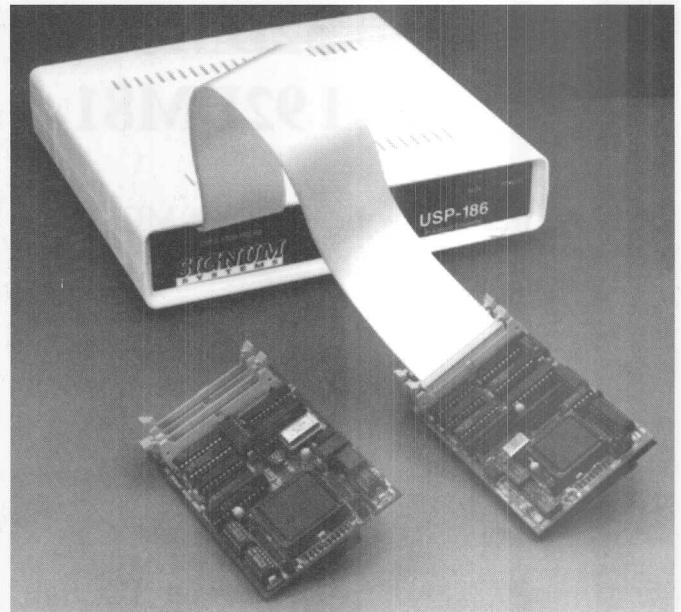
- ▲ Up to 256KB of dual-ported zero-wait-state emulation memory allows read & write access during execution
- ▲ Non-intrusive emulation up to 20 MHz
- ▲ Supports 80C196KX, 80C198, 8096BH, 80C196NT/NP microcontrollers
- ▲ Foreground and background monitor
- ▲ Source level debugging for ASM, C & PL/M
- ▲ 32K by 80-bit selective trace buffer
- ▲ 32-bit synchronized time stamp
- ▲ Complex hardware breakpoints and passpoints
- ▲ Up to 256K of address and data match comparators
- ▲ INST split memory support
- ▲ Execution coverage monitor
- ▲ High speed serial interface to a PC host (no plug-in cards)

### Contact Information

Signum Systems  
171 E. Thousand Oaks Blvd., #202  
Thousand Oaks, CA 91360  
Tel: (800) 838-8012  
Tel: (805) 371-4608  
Fax: (805) 371-4610

# SIGNUM

S Y S T E M S



### Product Information

USP-96 offers true real-time in-circuit development and debugging in machine code, assembler source, and High Level Language (HLL) modes.

USP-96 comes complete with 64KB of code memory (256 KB true banking model optional), source debugger for C, PL/M and ASM, 32K of 80-bit wide trace, and a sophisticated Event Triggering System that uses combinations of address and data comparators, sequencer, external probes, and pass counters to create almost any complex trigger condition.

The zero-wait-state, dual-ported emulation memory allows the user full read/write access, without slowing down the running processor. Watching and modifying the variables and parameters may be done without stopping the processor (and waiting for the motors or systems to stabilize each time!).

Selective tracing of only the meaningful data is easily achieved with the aid of the Event Triggering System. A 32-bit time stamp displays exact time relationships between instructions and routines in absolute or relative modes. Unique Foreground Monitor feature facilitates unimpeded user interrupt servicing during breakpoints (crucial in applications which must react to real-time events during debugging!).

Unlimited number of breakpoints and passpoints may be set or cleared with a mouse, by simply clicking on the desired instruction in the Source window. You can watch variables change on-the-fly, and zoom in on any member of a complex structure with a click of a mouse.

The CPU is mounted on a probe assembly, as close as possible to the target system for best possible emulation.

### Other products

Signum carries a full line of emulators for 80C51, 80C196, 80C186, 80386, 80486.

## 32GPX and 32DM81 TLA510 and 92DM81

### 32GPX and 32DM81 TLA510 and 92DM81

- ▲ Real-time symbolic debug of MCS® 96 architecture systems
- ▲ Trace identifies instructions actually executed and branches taken
- ▲ Single connection probe adapters for most MCS® 96 architecture devices
- ▲ 80 to 100 MHz state acquisition
- ▲ Timing analysis on all channels through same probe adapter
- ▲ Real-time performance analysis
- ▲ Links to high-level languages
- ▲ Prices start at \$9,000



#### Product Information

The GPX Logic Analyzer is a general-purpose instrument with features for everyone on the design team. Complete systems for microprocessor analysis start at \$9,000. The GPX series comes in a 3001GXP monolithic unit or a 3002 modular mainframe. Both units offer a 64MB hard disk and an MS-DOS compatible floppy for data storage, keyboard, and a variety of monochrome and color displays. The GPX offers 80 to 160 channels of 80 MHz state acquisition; 200 MHz transitional timing analysis on all channels; 16 to 32 channels of 1 GHz timing acquisition (40K deep); true simultaneous state and timing analysis without double probing; real-time performance analysis; and links to high-level languages such as C, C++, Pascal, and Ada.

The TLA510 Logic Analyzer is a modular instrumentation platform that you can operate locally using a color X-terminal or from a workstation via a standard X11/R4 server. Host communication is supported via LAN, or RS 232. The TLA510 contains a highly integrated acquisition module designed specifically to address the demanding requirements of the fast, wide, complex buses of today's microprocessors. The 96 channels of 100 MHz synchronous acquisition on each module lets you use multiple modules to support multiple microprocessors with no compromises in speed or timing. Memory depths from 8K samples to 2M samples lets you capture both the symptom and cause of complex problems. The TLA510 offers software performance analysis at full speed with up to 5,000 symbolic ranges.

#### Contact Information

Tektronix, Inc.  
P.O. Box 1520  
703 West Housatonic Street  
Pittsfield, MA 01202-9864  
Tel: (800) 426-2200  
Fax this page with your business card attached to  
Fax: (413) 448-8003  
WWW: <http://www.tek.com>

# Tektronix

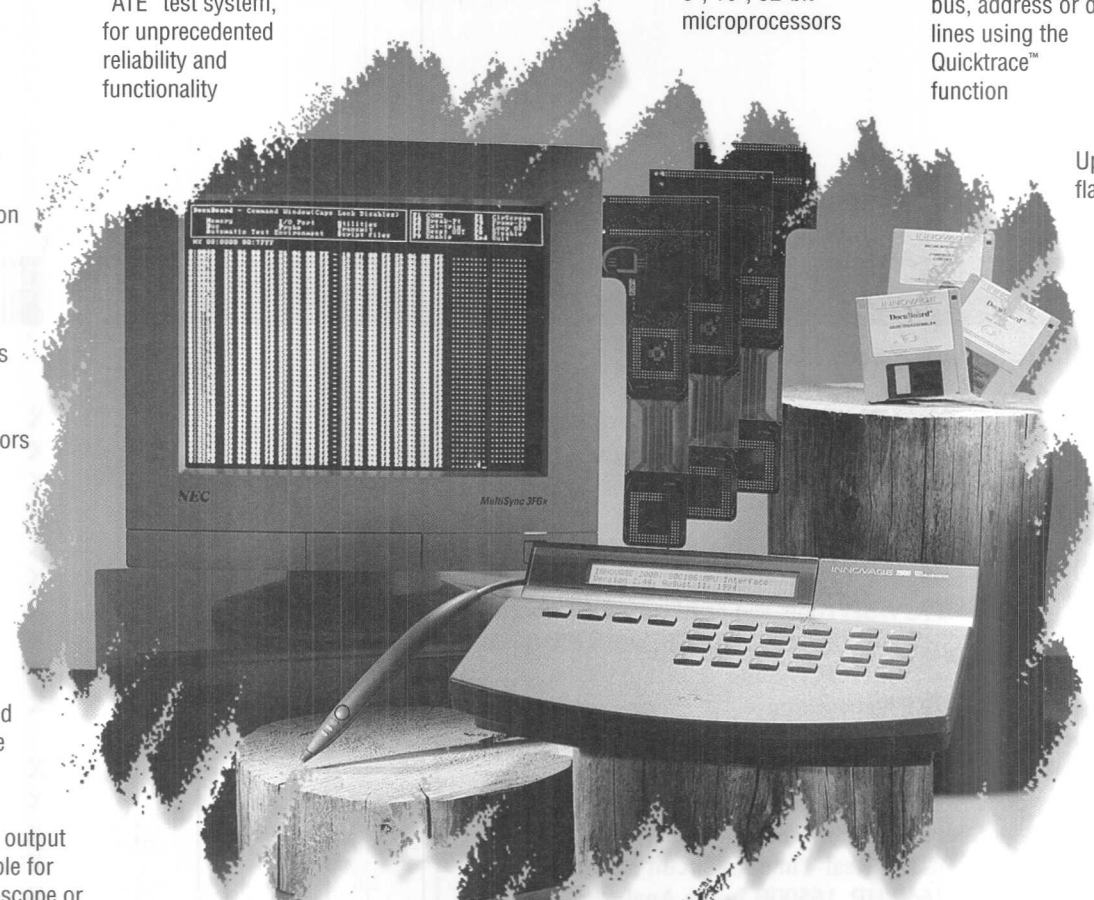
# Section V 80C186 Development Tools

COMPANY	PRODUCT	ARCHITECTURES					PG.
		MCS® 51	MCS® 251	MCS® 96	80C186		
<b>186Ex Integrated Microprocessor Family (Article)</b>						<b>125-27</b>	
<b>Software Development Tools</b>							
CAD-UL	Organon Cross-Software Dev. Environment				X	128	
Concurrent Sciences	Soft-Scope Remote Target Debugger				X	129	
DDC-I	DACS-80x86 Compilers/Debuggers			X	X	130	
Innovage Technologies	Docuboard™				X	131	
KADAK Products	AMX™86 Real-Time Multitasking Kernel				X	132	
Paradigm Systems	Paradigm C/C++ PowerPak				X	133	
Systems & Software	OMF/CV/SP/Tools and SoftProbe for Windows				X	134	
Tektronix	32GPX and 32DM06, TLA510 and 92DM06A				X	135	
US Software	SuperTask! RTOS Suite	X		X	X	136	
US Software	USNET Networking	X		X	X	137	
<b>Hardware Development Tools</b>							
Applied Microsystems	CodeTAP-XA In-Circuit Emulators				X	138-39	
Ceibo	DS-186 In-Circuit Emulator				X		
CheckMate Systems	CheckMate-C186/88 Emulators			X	X	141	
Emulation Technology	ET-iC186 Real-Time In-Circuit Emulator				X	142	
Hewlett Packard	HP 1660/HP, 16500B Logic Analyzers			X	X	143	
Hewlett Packard	HP 64767-Series Emulators				X	144	
HiTech Equipment	80C188 Single Board Computers				X	145	
Hitex	teletest 16 In-Circuit Emulators				X	146	
Innovage Technologies	Microprocessor System Board Tester				X	147	
iSYSTEM	iC2000 Power Emulator				X	148	
Lauterbach Datentechnik	TRACE32 In-Circuit Emulator				X	149	
Microtek International	MICE-IIIS 80C186 In-Circuit Emulator				X	150	
Noral Micrologics	SDT-Xi Universal In-Circuit Emulator				X	151	
Signum Systems	USP-186 In-Circuit Emulator				X	152	
Softaid	UEM-186 Emulator				X	153	
TechTools	UniROM Hdw enhancement for Debugging	X	X	X	X	154	
Tektronix	TLS 216 Logic Scope	X	X	X	X	155	

# INNOVAGE 2000

## *The Microprocessor System Board Tester for the Future...*

In today's fast paced world of test and measurement, the Innovage 2000 stands above the competition. By utilizing static memory based LCA's (Logic Cell Arrays) and flash memory, the customer can be assured that their instrument will never be outdated or obsolete.



FPGA logic coupled with flash memory augments a flexible "ATE" test system, for unprecedented reliability and functionality

ATE (Automatic Test Environment) usage for production testing and troubleshooting

Supports Intel 8-, 16-, 32-bit microprocessors

Probe routines for quick problem isolation. Run down bus, address or data lines using the Quicktrace™ function

FCC/DOC Approved modem for uploading configuration files

Disassemblers available for Intel Microprocessors

Stand alone or remote usage

Three-state synchronized digital probe

Synch output available for oscilloscope or other bus event triggered test equipment

Interchangeable microprocessor interfaces

External I/O modules can be easily integrated into the ATE testing for functional testing beyond the kernel

Powerful flexible FPGA logic

Various clip and cable assemblies are available

Bench top based central unit

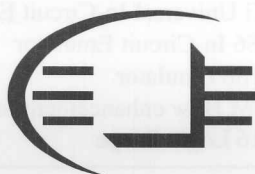
Upgradability via flash memory

Advanced "ATE" troubleshooting tool

"Discover" functions of DocuBoard™ allows memory mapping of unknown UUT

Host system can be any IBM® PC compatible system with a least one standard RS-232 serial port

Menu driven test routines



**Innovage Technologies Inc.**  
# 210, 239 Midpark Way SE  
Calgary, Alberta T2X 1M2  
Tel: (403) 254-2205  
Fax: (403) 254-2935  
Toll Free: 1 (800) 463-4997



# 186Ex Integrated Microprocessor Family

**I**ntel's 186 Integrated Microprocessor Product Family is the industry standard among high integration microprocessors. The traditional Intel architecture is highly successful in the embedded world with over six thousand design wins in applications ranging from Cellular Phones, LAN Boards, Modems, Hard Disk Drives, etc. Intel's next generation 80C186 products, the 80C186EC/EB/EA are in production now. Based on the static, 1 micron 186 modular core, the EC/EB/EA operates up to 25 MHz at 5 volts. For power sensitive applications, 3 volt versions are also available. Intel has a broad portfolio of 186 integrated microprocessors to choose from to meet your varying peripheral, performance, power and packaging requirements.

## 186Ex Processor Family

The 80C186Ex/C188Ex processors have a common set of base peripherals beneficial to many embedded applications. The Ex processors all support a standard numerics interface, an interrupt control unit, a chip-select unit, a DRAM refresh control unit, a power management unit, and three 16-bit timer/counters.

The power management unit is unique to the 186Ex proliferations. The power management unit offers two special operating modes: idle mode and powerdown mode. The idle mode allows the device

to shut off the CPU clock, leaving all integrated peripherals active. Idle mode lowers processor current consumption by approximately 40 percent. Powerdown mode goes a step further, the clock input to the entire processor is disabled reducing device current consumption to transistor leakage (microamps). These power management functions, plus optional Operation down to 2.7 volts make the EX family processors ideal for power-sensitive applications.

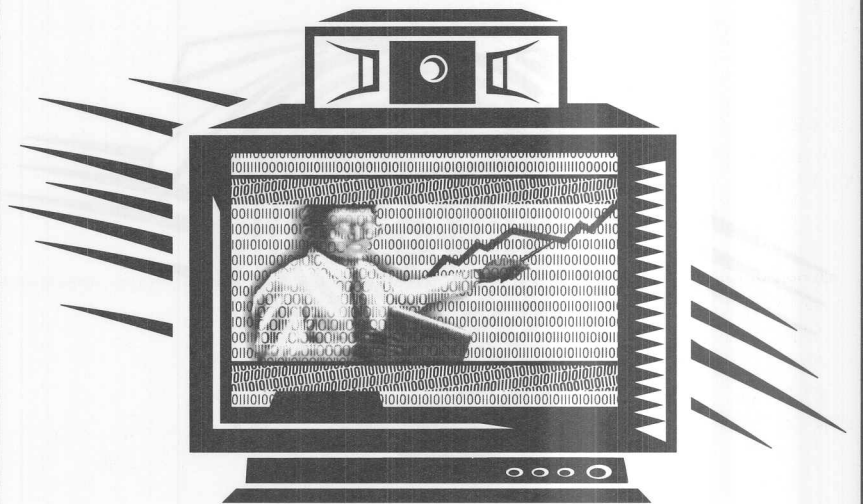
The integrated peripherals common to all of the 186Ex processors offer func-

tionality required in many embedded applications. By offering these functions on silicon, system size, complexity and cost are reduced while reliability is increased. The 80C186EC alone replaces up to 40 devices in a system.

## 80C186EA/80C188EA for Power Sensitive Applications

The 80C186EA offers a simple upgrade from the standard Intel 80C186 processor for power-sensitive applications. The processor offers all of the functional-

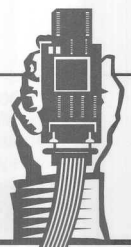
### CheckMate helped PictureTel visualize their '186 code.



When PictureTel wanted to boost productivity, the clear picture was to call CheckMate. Guaranteed to run in target, at 1/3 the cost of traditional box emulators, CheckMate helps more x86 designs than any other. Make your next design faster and easier. Call CheckMate at 1-206-869-7211.



**CheckMate Systems** Emulation for the masses.  
P.O. Box 3361, Redmond, Washington 98073-3361, FAX 206-861-3647



ity of the standard 80C186 plus an integrated power management unit and a fully static design. The 80C186EA not only offers lower power consumption, but higher performance. For example, when the EA operates at 20 MHz at 5 volts it consumes less than two-thirds of the power of a standard 80C186 operating at 16 MHz. Minimal hardware and software changes are required to convert an existing 80C186 design to an 80C186EA.

The low power consumption and power management capabilities of the 80C186EA allow designs previously requiring a bulky power supply to become battery operated. Battery operation opens new possibilities for portable/mobile designs. To achieve extremely low power consumption, the 80L186EA also operated down to 2.7 volts at frequencies up to 13 MHz.

## 80C186EB/80C188EB for Portable Data Acquisition or Communication Applications

The 80C186EB takes the base set of peripherals on the Ex family and adds two integrated serial ports. The ports support both synchronous and asynchronous communications.

The serial channels make inter-processor and display communications simple.

The EB also implements an enhanced chip-select unit and 2 multiplexed I/O ports. The enhanced chip-select unit offers 10 general chip selects, each with the ability to address up to 1 megabyte. This enhanced unit enables applications to implement memory bank switching to expand the 80C186 one megabyte address space. The I/O ports allow the application to do basic functions such as scanning keypads for input. The ports can also be implemented to control system power consumption, disabling unneeded components.

The serial ports, I/O capabilities and enhanced chip-selects make the EB an excellent processor for portable data acquisition or communication applications. The power management modes and optional low voltage operation make

the 80L186EB ideal for battery operated systems.

## 80C186EC/80C188EC for Portable, Low Power Applications

The 80C186EC is the highest integration member of the 80C186Ex processor family. All of the functionality of the 80C186EB is included with the addition of a 32-bit watchdog timer, 4 DMA channels, two enhanced 82C59 compatible interrupt controllers, and an additional I/O port. Even with the increased integration, the 80C186EC processor consumes no more power than the 80C186EB.

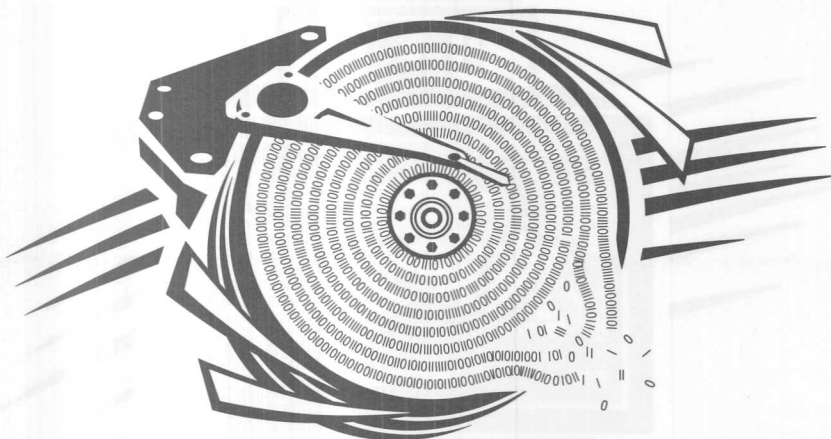
The 80C186EC allows the serial ports to make DMA requests, avoiding the interrupt latency required to service serial interrupts. The increased data throughput allows rapid data acquisition and processing. The enhanced chip-select unit also offers the possibility of increased data storage capacity.

The very high integration and low power consumption of the 80C186EC offer a simple solution for portable, low power applications focused on data acquisition and processing. Low voltage operation is also a significant benefit to extremely power-sensitive designs.

For the Intel 186 standard family, the numbers tell the story: more than 10,000 design wins and 50 million units shipped in its 12 years of production. With the 186 family of products, you can determine the cost and performance requirements for your embedded design and then choose from a wide variety of options: CHMOS, HMOS, 8- and 16-bit external versions.

The 80C186/188XL family is pin-for-pin compatible with the 80186/188 family while adding an enhanced feature set. The high performance CHMOS process allows the 80C186/188XL to run at twice the clock rate of the HMOS 80186/188 while consuming less than one quarter the power. However, the 80186/188 remains ideal for your price-sensitive designs that are not power sensitive.

### CheckMate helped Micropolis debug their '186 code.

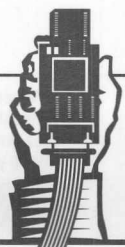


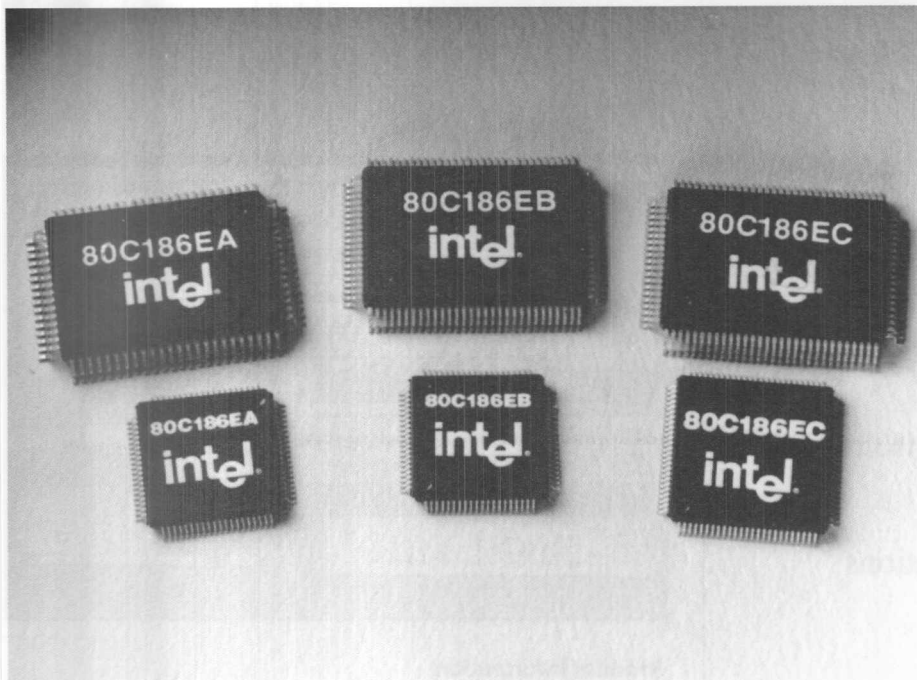
When Micropolis decided to replace their various emulators, they called on CheckMate to ICE their needs. Guaranteed to run in target, at 1/3 the cost of traditional box emulators, CheckMate helps more x86 designs than any other. Make your next design faster and easier. Call CheckMate at 1-206-869-7211.



**CheckMate Systems** Emulation for the masses.

P.O. Box 3361, Redmond, Washington 98073-3361, FAX 206-861-3647





## FEATURES

- 16 bit CPU (XL operating at 25 MHz)
- 8086 instruction set. 1M byte addressing
- On-Chip Peripherals
- 8-bit external bus available
- Direct numerics interface (80C187)
- Intel 186 Enhanced Products Family

## BENEFITS

- Speed** — 1 MIP performance.
- Easy debugging** — Use your PC for quick software development and debugging.
- Abundant storage** — Large address space for programs and data.
- High integration** — Enables low-cost and low chip count designs.
- Low cost** — Lower memory and system cost.

In 1990, Intel designed these products to meet your performance, integration and power consumption needs. Intel modularized the core architecture in order to easily proliferate the family. The 80C186Ex family features an improved static, 1 micron design and all of the enhanced products run at 25 MHz. In addition, the Ex family products incorporate new features (serial channels, DRAM refresh control, power management) to provide you more functionality. The Ex core has also been enhanced to run at 3 volts.

## FEATURES

- 3-stage power management unit
- 3.0 volt versions
- Watch dog timer (EC only)
- DMA Channels (EA/EC only)
- Serial Channels (EB/EC only)

- CMOS inputs and outputs
- ONCE Mode (System-level testing)
- I/O ports (EB/EC only)

## BENEFITS

- Efficient** — Low power consumption
- Mobile** — Enables portable, battery powered designs
- Durable** — Ensures system integrity in hostile environments
- Fast** — Allows high-speed data movement
- Interfacing** — Facilitates interprocessor communication and modem interface
- Less Noise** — Improved noise margins
- Testing** — On-board device testing and inspection capabilities
- Communication** — Ability to communicate externally via standard operating systems



# Cross Compiler

# Organon<sup>®</sup>



**Choose this complete toolset: compiler, assembler, and linker all from the same company. Specially designed for embedded development and the Intel 8086/80186/80286.**

*for the Intel<sup>®</sup>*

**8086/80186/80286**

Computer Aided Design Ulm GmbH  
P.O. Box 1280 D-89002 Ulm, Germany  
Tel. +49 731 93760-60  
Fax +49 731 93760-27  
e-mail: sales@cadul.de

All trademarks owned by their respective companies.

- Compatible with Intel i86.
- For use with C++ and ANSI C.
- Optional: Our powerful high-level language debugger Organon XDB 86 for ROM monitor, emulator, and RT kernels.
- Available for workstations, MS-DOS, and MS-Windows.



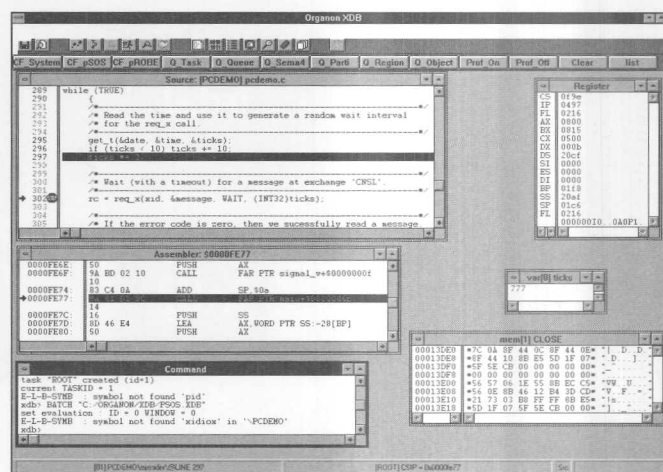
## Organon Cross-Software

## Organon Cross-Software Development Environment

- ▲ Integrated Development Environment
- ▲ C++ support
- ▲ Provides Intel compatible options
- ▲ Reentrant code
- ▲ ROM-compatible code
- ▲ Supports OMF86/OMF386 object format
- ▲ Able to read Microsoft™ C
- ▲ Runs on PC/MS-DOS, PC/UNIX, Sun OS and Solaris 2.x, VAX/VMS, VAX/ULTRIX, DEC/ULTRIX and HP 9000/700 and HP APOLLO
- ▲ Includes powerful Cross Debugger with GUI
- ▲ Offers MS-Windows™ 3.1, Windows NT and OSF-Motif versions

## Contact Information

CAD-UL GmbH  
Einsteinstr. 37  
89077 Ulm, Germany  
Tel: (49) 731/937600  
Fax: (49) 731/9376027



## Product Information

CAD-UL offers professional, high-quality cross- and native software development tools for Intel target processors. Our customers make great advances in productivity with the software-tools of CAD-UL.

The ORGANON ANSI-C Cross Optimizing Compiler is one of CAD-UL's software tools. The ORGANON ANSI-C Cross Optimizing Compiler has been developed by CAD-UL for professional use and for a wide area of application. Intel options for example:

*#pragma fixedparams, varparams*

*#pragma align, noalign are supported.*

The innovative C-Compiler enables switchable optimizing routines, user-defined-intrinsic-functions, supports real-time kernels like pSOS+, etc.

A real highlight in the continuous CAD-UL development line is the Organon XDB86 High-level Language Debugger. With Organon XDB86 you can test your software comfortably and effectively.

Since Organon XDB86 supports the connection to in-circuit emulators such as the Hewlett Packard 64700 series, or AMC, you can test your applications in real time. You can evaluate complex expressions with Organon XDB86 (CAST operations are permitted). The dynamic call hierarchy can be displayed, even local stack variables of any function in the call hierarchy. Of course, you can also display variables and register contents, display and modify memory areas, run your program in single-step, and much more. All this with graphic windows and full mouse support! To offer you the greatest possible comfort when testing your software, you can also run Organon XDB86 in the network. This gives you the possibility of debugging on your hardware via Ethernet. Organon XDB is also available as a native debugger on many UNIX systems. Thus the user is provided with the same debug user interface for both cross and native developments.

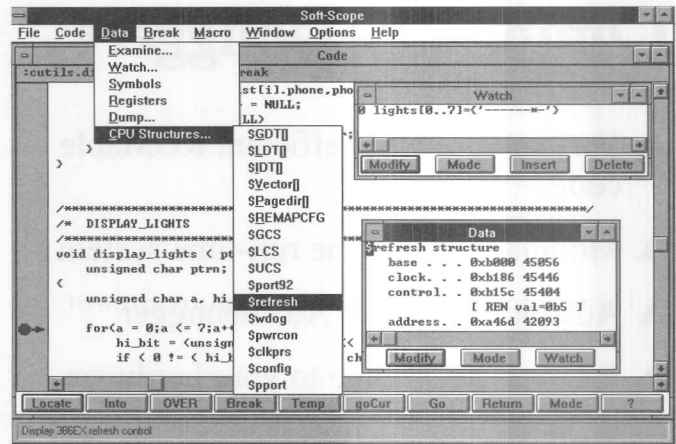


## Soft-Scope® Remote Target Debugger

- ▲ Supports C/C++ compilers from Microsoft, Borland, Watcom, MetaWare and Intel
- ▲ For real- and protected-mode 16- and 32-bit embedded applications
- ▲ Supports entire 80x86 family including 8086, 8088, 186, 188, 286, 386, Intel386™EX, 486, and Pentium® microprocessors
- ▲ Available as a DOS or Windows™ application
- ▲ Works with our CSi-Locate utility (sold separately) that absolutely locates code generated by C/C++ compilers
- ▲ Supports Tektronix logic analyzers and in-circuit emulators from Applied Microsystems and Hitex
- ▲ Supports Intel's iRMX® software, JMI's C EXECUTIVE® and Industrial Programming's MTOS™
- ▲ Includes royalty-free monitor with complete source code

### Contact Information

Concurrent Sciences, Inc.  
P.O. Box 9666  
530 S. Asbury  
Moscow, ID 83843 USA  
Tel: (208) 882-0445  
Fax: (208) 882-9774  
E-mail: info@consci.com



- ▲ Supports extended register set, descriptor tables (GDT, IDT, LDT) and protection traps
- ▲ Access memory and view data references while target is running
- ▲ Stop target when no breakpoints are set
- ▲ Set software and hardware breakpoints in RAM and ROM
- ▲ Step *n* times, step into or over procedures, go to cursor position, go until breakpoint, fault or key press, go until return from procedure *n* times
- ▲ Click on a pointer to display and follow linked lists
- ▲ Click on variable to view or modify its value, type and address; click again to place it in a watch window
- ▲ Click on function call to see source code
- ▲ Windows for displaying source code, data, memory, watch variables, registers, trace, help, processor structures, log files and symbols including arrays, structures, unions and enumerated types
- ▲ Supports application I/O
- ▲ Works like a simulator when target is another PC

## DACS™-80x86

## Compilers/Debuggers

- ▲ Very compact and efficient ROMable code
- ▲ Modular stand-alone run-time system
- ▲ Advance symbolic Ada debugger
- ▲ Easily configurable to your hardware
- ▲ Stack size analysis tool
- ▲ CIFO and RTS entry point packages
- ▲ Supports rate monotonic scheduling
- ▲ Fast and normal interrupt handling
- ▲ Fast ethernet downloading
- ▲ Selective linking
- ▲ Bare PC target
- ▲ FAA certification available (also tasking)

### Contact Information

U.S. and Canada:  
DDC-I, Inc.  
410 North 44th Street  
Phoenix, AZ 85008  
Tel: (602) 275-7172  
Fax: (602) 275-7502

International:  
DDC-I A/S  
Gl Lundtoftevej 1B  
DK-2800 Lyngby  
Denmark  
Tel: 45 45 87 11 44  
Fax: 45 45 87 22 17



**The Language For A Complex World**

### Product Information

The DDC-I Ada Compiler System for Intel 80x86, DACS-80x86, has been designed to fully utilize the features of each processor, with special emphasis on the needs of true real-time embedded systems. Continuously validated since 1987, DACS-80x86 is a highly mature development system, field proven by hundreds of applications.

The DACS-80x86 Ada cross debugger offers a full-featured multi-windowed symbolic debugging environment with Motif-style GUI, ethernet downloading, break one tasking and is easily configurable to custom hardware. The stand-alone Ada run-time system requires no underlying kernel and ranges from 4 to 24K bytes in size.

Other tools and options include assembler, librarian, linker (with locate/build/facility), OMF utilities, disassembler, refather tool for configuration of libraries, make tool, object map tool for ICE support, stand-alone ether and serial downloader, GUI integrator for integration of external tools, Multibus II communications packages, TCP/IP, rate monotonic scheduling, FAA RTS certification support, and RTS source code.

DDC-I also provides full consultation, installation support, training classes, and custom software tailoring for applications and development environments. DDC-I's technology source centers are equipped with many single board computer environments and application test equipment to service each customer's specific needs and budget.

For more details about the DACS-80x86 Ada compiler system or any other products or services, contact the sales office nearest you.

### Processors Supported

8086/8088 Real Mode, 80186/80188 Real Mode, 80286 Real Mode, 80286 Protected Mode, 80386 Protected Mode, 80386EX, 80486, 80486DX2, 80486DX4, Pentium® microprocessor.

### Host Systems Supported

Sun SPARC/Solaris, Sun SPARC/Sun OS, and VAX/VMS



## DocuBoard™

- ▲ Menu Driven Test Routines
- ▲ FCC/DOC Approved modem for uploading configuration files
- ▲ ATE (Automatic Test Environment) usage for production testing and troubleshooting
- ▲ External I/O modules can be easily integrated into the ATE testing for functional testing beyond the kernel
- ▲ "Discover" functions of DocuBoard™ allows memory mapping of unknown UUT
- ▲ Probe routines for quick problem isolation. Run down bus, address or data lines using the Quicktrace™ functions
- ▲ Synch output available for Oscilloscope or other bus event triggered test equipment
- ▲ FPGA logic coupled with flash memory augments a flexible "ATE" test system, for unprecedented reliability & functionality in the test and measurement world
- ▲ Various clip and cable assemblies are available
- ▲ Host system can be any IBM® PC compatible system with a least one standard RS 232 serial port
- ▲ Disassemblers available for Intel microprocessors
- ▲ Expansion port for future enhancements



### Test Software

The DocuBoard™ series of software has many tools that are necessary to easily develop test solutions for micro-processor based UUTs, even when little or no documentation exists. Every test engineer has faced a situation where memory maps for a UUT are not available, with limited or no access to the source. The UUT EPROMS contain all of the pertinent information about the UUT. This "test knowledge" contained in the EPROMS can be accessed by the DocuBoard software and used to initialize and exercise the UUT peripherals.

The DocuBoard report generator and disassemblers can help create this information. The Report Generator will supply the memory map. All the user has to do is attach the logic probe to the peripheral and memory device chip select pin and let the Innovage 2000 and Report Generator do the rest of the work. Once the memory map has been established, the next hurdle to overcome is writing the test routines that allow the technician to initialize and exercise the peripherals of the UUT. The best initialization and exercise routines will reside in the system's firmware. This process can be accomplished by using the Innovage 2000 upload command and DocuBoard™ disassemblers to generate a source code listing and cross reference table. The memory map and firmware listings can now be used to generate Automatic Test Routines with the DocuBoard™ software. The only thing required to generate DocuBoard™ ATE routines is a known good UUT and the Innovage 2000, since all tests are menu driven. Since systems can have a multitude of peripherals, the DocuBoard™ ATE software supports project files, which are composed of individual ATE test routines. Once a test failure occurs, the failing test file can be used to troubleshoot and/or verify the failing device(s).

### Remote Operation

The Innovage 2000 Includes a FCC/DOC approved modem that allows a support engineer to execute tests and assist in diagnosing and troubleshooting a remote system.

### Contact Information

Innovage Technologies, Inc.  
 #210, 239 Midpark Way SE  
 Calgary, Alberta T2X 1M2  
 Tel: (800) 463-4997  
 Tel: (403) 254-2205  
 Fax: (403) 254-2935

## AMX™86 Real-Time Multitasking Kernel

- ▲ For real mode x86/x88 microprocessors
- ▲ Full-featured, compact ROMable kernel with fast interrupt response
- ▲ Preemptive, priority based task scheduler with optional time slicing
- ▲ Mailbox, semaphore, resource, event, list, buffer and memory managers
- ▲ Configuration Builder utility eases system construction
- ▲ InSight™ Debug Tool is available to view system internals and gather task execution information
- ▲ PC device support and DOS compatible file I/O
- ▲ Clear and comprehensive documentation
- ▲ No royalties to pay
- ▲ Includes source code
- ▲ KADAK and AMX have developed a reliability and support track record

### Contact Information

KADAK Products Ltd.  
206-1847 West Broadway Avenue  
Vancouver, BC V6J 1Y5 CANADA  
Tel: (604) 734-2796  
Fax: (604) 734-8114



### Product Information

AMX™86 is a real-time operating system for x86/x88 microprocessors operating in real mode. The AMX family of kernels, first released in 1980, is used by more than 1,000 developers worldwide.

### AMX features include

- Nested interrupts with priority ordering
- Preemptive, priority based task scheduler
- Timing support for delays, timeouts, periodic events
- Time slicing option with adjustable slices
- Message passing with configurable message length
- Dynamic task creation and dynamic task priorities

### Managers are provided for

- Semaphore signalling and resource allocation
- Event synchronization
- Mailboxes and message exchanges
- Fast, fixed size memory buffer allocation
- Dynamic memory allocation similar to *malloc()*
- Linked lists and circular lists

### PC support provides

- PC device access
- DOS function call and file I/O support
- DOS command processor access

### Development Support

- Configuration Builder utility
- AMX is available for a wide range of target processors
- Comprehensive, simple-to-follow documentation including sample programs

### Product Support

- Prompt and courteous technical support by telephone or fax
- Reference manual highlights answers to the more common technical support questions
- AMX source code included to ease updates
- Software updates included for one year
- AMX reliability field-proven since 1980



# Paradigm C/C++ PowerPak

## Paradigm C/C++ PowerPak

- ▲ Support for the latest Borland and Microsoft® C/C++ compilers
- ▲ Full C++ support, including templates and exception handling
- ▲ Complete run-time library support for floating point, dynamic memory management, and stream I/O
- ▲ Data compression, CRCs, checksums, and more
- ▲ Choice of stand-alone or in-circuit emulator debugging
- ▲ Unlimited free technical support via phone, fax, BBS, or e-mail

### Ordering Information

- |                           |   |
|---------------------------|---|
| • Paradigm C/C++ PowerPak | \$995.00  |
| • Paradigm LOCATE         | \$595.00  |
| • Paradigm DEBUG/RT-186   | \$595.00  |
| • Emulator PowerPaks      | Contact emulator vendor or Paradigm for details |

### Contact Information

For more information on any Paradigm product:

Paradigm Systems

3301 Country Club Road, Suite 2214

Endwell, NY 13760

Sales: (800) 537-5043

Technical support: (800) 582-0864

International sales/support: (607) 748-5966

Fax: (607) 748-5968

BBS: (607) 786-0705

Internet: 73047.3031@compuserve.com

The screenshot displays the Paradigm C/C++ PowerPak debugger. The main window shows assembly code for a module named 'reverse'. The code includes instructions like 'cout << "for you until you enter the string \"reverse.\" Reverse\n";', 'cs:0112 59 pop cx', 'cs:0113 0BC0 or ax,ax', 'cs:0115 740C je 0123', 'reverse#67: theStack.push( newString );', 'cs:0117 56 push si', 'cs:0118 8D46F6 lea ax,ebp-0A1', 'cs:011B 50 push ax', 'cs:011C E8700F call stack::stack:', 'cs:011F 59 pop cx', 'cs:0120 59 pop cx', 'cs:0121 ED02 jmp 0125', 'cs:0123 ED02 jmp reverse#75', 'cs:0125 EBC5 jmp reverse#63', and 'reverse#75:'. The registers window on the right shows values for ax, bx, cx, dx, si, di, bp, sp, ds, es, ss, and ip. The status bar at the bottom indicates 'F1-Help F2-Bkpt F3-Mod F4-Here F5-Zoom F6-Next F7-Trace F8-Step F9-Run F10-Menu'.

### Product Information

The Paradigm C/C++ PowerPak is the premier embedded development solution for the entire Intel 186 family of microprocessors. Supporting the latest releases of the popular Borland C++ and Microsoft C/C++ compilers, the Paradigm C/C++ PowerPak is unmatched in delivering the most powerful PC-hosted compiler and debugging technologies to meet the demanding needs of embedded system developers.

Complete with ROMable startup code, run-time library support for floating point, stream I/O, dynamic memory management, and more, Paradigm LOCATE is unmatched in its ability to support the most demanding requirements of your application. Backed up with numerous examples, makefiles and support for integrated development environments, no other solution can come close to that found in Paradigm LOCATE.

Paradigm DEBUG/RT, based on the award-winning Turbo Debugger from Borland, guarantees that you have access to the most powerful debugging tools available, and at a price that is more than affordable. Use Paradigm DEBUG/RT to debug your application on your target system, with full support for watches, inspectors, complex breakpoints, session-state saving and more.

For developers requiring the non-intrusiveness of a powerful in-circuit emulator, Paradigm DEBUG is also available for in-circuit emulators from Applied Microsystems, Ceibo, CheckMate Systems, Emulation Technology, Hewlett-Packard, Intel, Microtek, Noral, ZAX and others. These versions of Paradigm DEBUG are enhanced to completely support the hardware event system, real-time trace, timestamp, overlay memory, and other in-circuit emulator capabilities.

As the acknowledged leader in C/C++ embedded system development, Paradigm has the knowledge and experience to provide comprehensive support for all aspects of 186 embedded system design. Our technical support is available to all Paradigm customers at no charge, and even the phone call is free. If the 186 is the core of your hardware design, then a Paradigm Powerpak is your ticket to faster, hassle-free embedded system software development.

# PARADIGM

# OMF/Tools, CV/Tools, SP/Tools and SoftProbe for Windows

## Embedded Development Solutions for x86/186/188/386/486

- ▲ Complete solutions:
  - DOS and Windows™ hosted
  - Advanced linker/locator/builders
  - Remote target debuggers
  - ROM emulators
  - In-circuit emulator support
  - Simulators for 386, Intel386™EX and 486 microprocessors
- ▲ Available as complete system packages or as individual components
- ▲ 16-bit and 32-bit development tools
- ▲ Real- and protected-mode support
- ▲ C and full C++ support
- ▲ Intel OMF and EXE format support
- ▲ User definable interfaces and configurable monitors
- ▲ Single point purchasing and technical support
- ▲ Training and educational seminars
- ▲ Major accounts program

**ssi**  
Systems & Software, Inc.

The screenshot shows a debugger window titled 'MS-DOS Prompt'. The main window displays source code with line numbers 16 through 30. The code includes a structure definition for 'struct node' and a loop that iterates through a list of nodes. The registers window on the right shows the values of various registers, including AX, BX, CX, DX, SI, DI, BP, SP, IP, and CS. The status bar at the bottom indicates the current instruction pointer (IP) is 002A.

### Product Information

SSI (Systems & Software, Inc.) is the leading supplier of development tools for 16- and 32-bit x86 embedded development. Offering a complete range of tools including: Linker/Locator/Builder; Remote Target Debuggers; Simulators; and ROM Emulators.

**CV/Tools** — For 16-bit real-mode C++ development using an enhanced version of the CodeView interface licensed from Microsoft. The CV/Tools packaged extends Microsoft's® Visual C/C++ optimizing Compilers and MASM assembler to meet the requirements of embedded development. The tool suite offers a powerful linker/locator, target debugger and run-time library support that is not DOS-dependent. CV/Tools offers complete support for both C++ and C debugging.

**OMF/Tools** — For 16-bit real- and 32-bit protected-mode application development using C and the Intel OMF format. The OMF/Tools package extends the standard optimizing compilers by Microsoft, Borland, MetaWare, WATCOM and MASM assembler to meet the requirements of embedded development. The tools suite offers a powerful linker/locator, target debugger and run-time library support that is not DOS-dependent. OMF/Tools offers complete support for C debugging, demangled C++ debugging, ROM- and in-circuit emulator support.

**SP/Tools** — For 32-bit protected-mode development that offers full MetaWare C++ as well as C support.

**SoftProbe for Windows** — SSI's new series of Windows hosted development tools for real- and protected-mode development.

### Contact Information

Systems & Software, Inc.  
18012 Cowan, Suite 100  
Irvine, CA 92714 USA  
Tel: (800) 788-4386  
Tel: (714) 833-1700  
Fax: (714) 833-1900  
BBS: (714) 833-8152

## 32GPX and 32DM06 TLA510 and 92DM06A

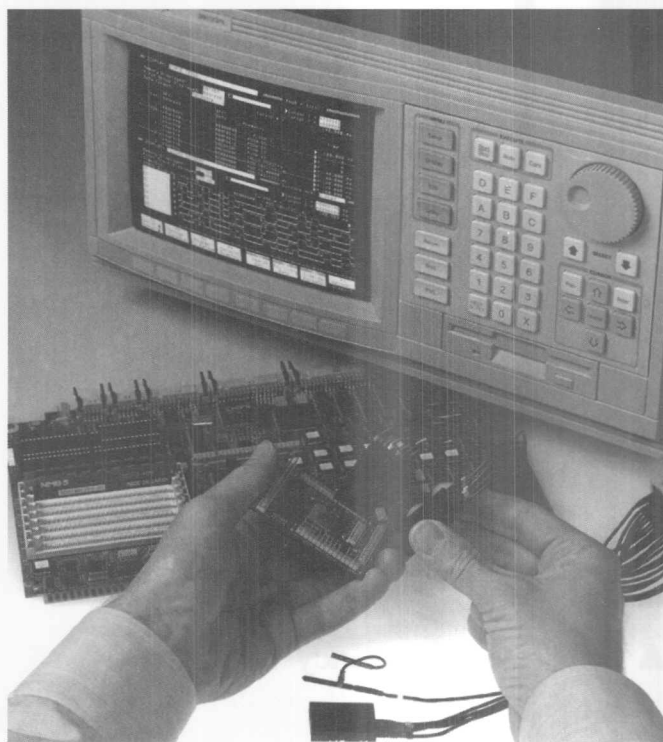
- ▲ Real-time symbolic debug of 80C186 architecture systems
- ▲ Trace identifies instructions actually executed and branches taken
- ▲ Single connection probe adapters for most 80C186 architecture devices
- ▲ 80 MHz state acquisition
- ▲ Timing analysis on all channels
- ▲ Perform bus timing measurements through probe adapter
- ▲ Real-time performance analysis
- ▲ Links to high-level languages
- ▲ Prices start at \$9,000

### Contact Information

Tektronix, Inc.  
P.O. Box 1520  
703 West Housatonic Street  
Pittsfield, MA 01202-9864  
Tel: (800) 426-2200  
Fax this page with your business card attached to  
Fax: (413) 448-8003  
WWW: <http://www.tek.com>

# Tektronix

## 32GPX and 32DM06 TLA510 and 92DM06A



### Product Information

The GPX Logic Analyzer is a general-purpose instrument with features for everyone on the design team. Complete systems for microprocessor analysis start at \$9,000. The GPX series comes in a 3001GXP monolithic unit or a 3002 modular mainframe. Both units offer a 64MB hard disk and an MS-DOS compatible floppy for data storage, keyboard, and a variety of monochrome and color displays. The GPX offers 80 to 160 channels of 80 MHz state acquisition; 200 MHz transitional timing analysis on all channels; 16 to 32 channels of 1 GHz timing acquisition (40K deep); true simultaneous state and timing analysis without double probing; real-time performance analysis; and links to high-level languages such as C, C++, Pascal, and Ada.

The TLA510 Logic Analyzer is a modular instrumentation platform that you can operate locally using a color X-terminal or from a workstation via a standard X11/R4 server. Host communication is supported via LAN, or RS 232. A highly integrated acquisition module addresses the demanding requirements of the fast, wide complex buses of today's microprocessors. You can use multiple modules to support multiple microprocessors with no compromises in speed or timing. Memory depths from 8K to 2M samples lets you capture both the symptom and cause of complex problems. The TLA510 offers software performance analysis at full speed with up to 5,000 symbolic ranges.

CSI-LINK is a PC-based software product that provides a link between Tektronix logic analyzers and almost any X86 family software tools. It extracts high-level symbol information from the object module and converts it to a format that can be downloaded to Tektronix logic analyzers to facilitate symbolic display and triggering.

## SuperTask! *RTOS Suite*

### US Software Tools SuperTask! *RTOS Suite*

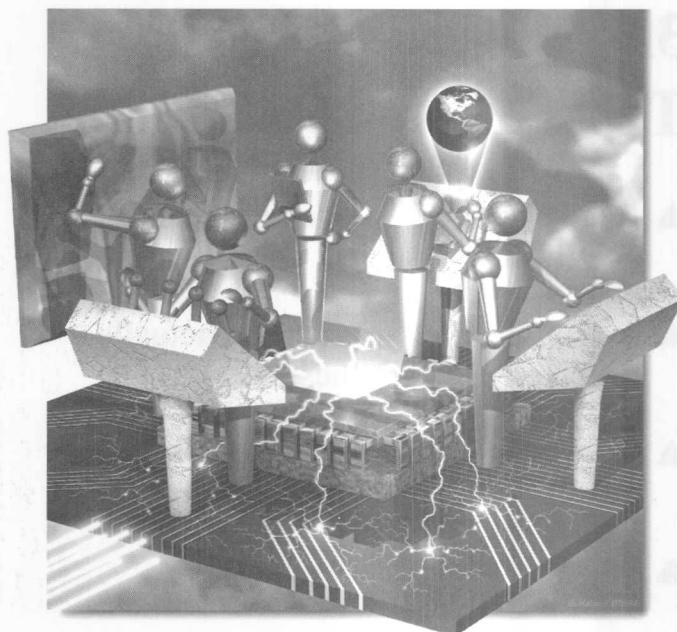
- ▲ ROMable & reentrant
- ▲ Compact & user configurable
- ▲ Includes boot code, C startup, and configuration code
- ▲ Full featured - over 70 system calls
- ▲ Includes serial stream I/O & drivers
- ▲ Fast task switch
- ▲ Low interrupt latency
- ▲ Full source provided
- ▲ Optional networking
- ▲ Optional file system

80C186 DEVELOPMENT TOOLS

#### Contact Information

US Software  
14215 N.W. Science Park Drive  
Portland, OR 97229  
Tel: (503) 641-8446  
USA: (800) 356-7097  
Fax: (503) 644-2413  
email: ussw@netcom.com

Call or fax for additional information and free evaluation diskettes.



#### Product Information

SuperTask!™ Multitasking Suite is a comprehensive multitasking package that includes design, prototype, and debug tools as well as a full-featured multitasking RTOS.

Develop and implement real-time multitasking applications using over seventy powerful system calls. Get complete source code with ANSI C stream I/O including sprintf and scanf.

#### Processors Supported

8051, 80196, 80x86, 386 Protected mode, 80960



# USNET *Networking*

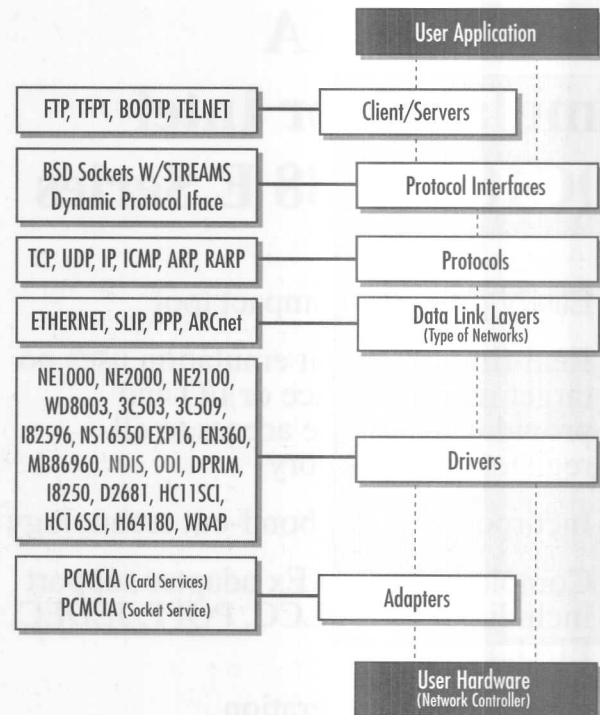
## US Software Tools USNET *Networking*

- ▲ RTOS/processor independent
- ▲ ROMable & re-entrant
- ▲ Compact & user configurable
- ▲ Includes Client/Servers  
BOOTP, FTP & TFTP
- ▲ Includes Protocols: TCP, UDP, IP  
ICMP, ARP, RARP
- ▲ Includes ethernet, SLIP & PPP support
- ▲ Includes drop-in toolchain support
- ▲ Full source provided

### Contact Information

US Software  
14215 N.W. Science Park Drive  
Portland, OR 97229  
Tel: (503) 641-8446  
USA: (800) 356-7097  
Fax: (503) 644-2413  
email: ussw@netcom.com

Call or fax for additional information and free evaluation diskettes.



### Product Information

USNET™ Processor Independent TCP/IP  
Supports Ethernet or Serial TCP/IP applications and protocols including FTP, TFTP, BOOTP, TCP, UDP, IP, ICMP, ARP, and RARP. Usable with or without a multitasking RTOS. Includes drop-in support for Intel processors and toolchains.

### Processors Supported

8051, 80196, 80x86, 386 Protected mode, 80960

## CodeTAP-XA 80C186

# CodeTAP-XA Emulator for Intel 80C186/C188 E Series

- ▲ Easily portable, compact tool
- ▲ Real-time in-circuit emulation uses no target memory space or I/O and provides read/write access to all registers and memory
- ▲ Incorporates Intel bond-out technology
- ▲ Complete 80C186 Ex adapter support including PGA, PLCC, PQFP, JEDEC, EIAJ, and SQFP
- ▲ Fully dynamic operation
- ▲ Target monitoring, including clock,  $V_{cc}$  and bus timeout
- ▲ 1MB zero wait state overlay memory; attributes include target or emulation, read/write, read-only or guarded
- ▲ Fastest download speeds (to 7M bytes/min)
- ▲ Event system combines hardware access and execution breakpoints with trace qualification for powerful conditional triggering

## Contact Information

Applied Microsystems Corporation  
5020 148th Avenue N.E.  
P.O. Box 97002  
Redmond, WA 98073-9702  
Tel: (800) 426-3925  
TRT Telex 185196  
E-mail: info@amc.com

Tel: (206) 882-2000  
Fax: (206) 883-3049  
Internet: <http://www.amc.com>



Applied Microsystems Corporation



## Product Information

CodeTAP emulators use patented emulation technology to incorporate the most-used debugging functions—such as software and hardware breakpoints and modification of memory and processor registers—in a low-cost, small-footprint device. Because CodeTAP doesn't require code modifications, target memory, interrupt vectors, or target I/O locations, you get a transparent, real-time view of your target.

## Next Generation Tool

The CodeTAP-XA (Extended Architecture) in-circuit emulator is a completely new level of CodeTAP, adding high-performance features useful to both hardware and software engineers. Included are a deep fully dynamic trace buffer, target monitoring and diagnostics, breakpoints on data match, and RS 232 and high-speed RS 422 communications. CodeTAP-XA also incorporates a powerful event system with four trigger levels, and up to 1MB of zero wait state overlay memory.

## Award-Winning Debugger

The popular Paradigm DEBUG™ includes custom peripheral register views for all 80C186 peripherals and accepts code from a wide variety of compilers. And because CodeTAP-XA supports the same user interfaces as the CodeTAP and full-scale EL 1600 emulators, you get a consistent debugging environment, with reduced learning curves and higher productivity.

## Processors Supported

80C186/188 EA, EB, EC, XL, 5 volt or 3 volt.

## Host Systems Supported

PC 386 or higher.

## Ordering Information

Call 1-800-426-3925 for ordering information and additional product information.

## In-Circuit Emulators for 80C18x Family

Processor	Emulator	CPU Package	Clock Speed*	Mask/Step Revision	Host Platform	Debugger	Compiler Toolchain	Simulator	ROM Monitor
80C18x 80C18xXL, 80L18xXL	EL1600 CodeTAP-XA CodeTAP	68-pin PLCC, 68-pin PGA, 80-pin PQFP, 80-pin SQFP	25 MHz, 12.5 MHz 3V	C*	PC	Paradigm, Paradigm or Softscope III (CodeTAP)	Microsoft, Borland, Intel, MRI, Intermetrics, Metaware	MRI	MRI, Paradigm
80C18xEA, 80L18xEA	EL1600, CodeTAP-XA CodeTAP	84-pin PLCC, 68-pin PGA, 80-pin PQFP, 80-pin SQFP	25 MHz, 12.5 MHz 3V	B*	PC	Paradigm, Paradigm or Softscope III (CodeTAP)	Microsoft, Borland, Intel, MRI, Intermetrics Metaware	MRI	MRI, Paradigm
80C18xEB, 80L18xEB	EL1600, CodeTAP-XA, CodeTAP	84-pin PLCC, 84-pin PGA, 80-pin PQFP, 80-pin PQFP	25 MHz 13 MHz 3V	B*	PC	Paradigm, Paradigm or Softscope III (CodeTAP)	Microsoft, Borland, Intel, MRI, Intermetrics Metaware	MRI	MRI, Paradigm
80C18xEC, 80L18xEC	EL1600, CodeTAP-XA, CodeTAP	100-pin PQFP (JEDC/EIAJ), 100-pin AMP, 100-pin SQFP	25 MHz 13 MHz 3V	B*	PC	Paradigm, Paradigm or Softscope III (CodeTAP)	Microsoft Borland, Intel, MRI, Intermetrics Metaware	MRI	MRI, Paradigm

\*Contact factory for latest information

**Contact Information**

Applied Microsystems Corporation  
5020 148th Avenue N.E.  
P.O. Box 97002  
Redmond, WA 98073-9702  
Tel: (800) 426-3925  
Tel: (206) 882-2000  
TRT Telex 185196  
Fax: (206) 883-3049  
E-mail: [info@amc.com](mailto:info@amc.com)  
Internet: <http://www.amc.com>



Applied Microsystems Corporation

## Ceibo DS-186 In-Circuit Emulator

- ▲ Support for 80C186/8/XL/EA/EB/EC, 8086/8
- ▲ Full speed emulation up to 30 MHz
- ▲ 1M byte of zero wait state mapped memory
- ▲ 8K frames dynamic trace buffer
- ▲ 1M qualified hardware breakpoints
- ▲ 115K Baud RS 232C communication link
- ▲ Paradigm DEBUG and LOCATE software
- ▲ Support for Borland, Microsoft® and Intel Compilers
- ▲ Full C, Pascal and Assembler expression evaluation
- ▲ Full support for C++

### Contact Information

Ceibo U.S.A.

7 Edgestone Ct.

Florissant, MO 63033

Toll Free (USA and Canada):

(800) 833-4084

Tel: (314) 830-4084

Fax: (314) 830-4083

France:

Tel: 62-072954

Fax: 062-072953

Germany

Tel: 061-5127505

Fax: 061-5128540

Holland

Tel: 5427-33333

Fax: 05427-33888

Israel

Tel: 972-9-555387

Fax: 972-9-553297

Italy

Tel: 051-727252

Fax: 051-727515

South Africa

Tel: 011-8877879

Fax: 011-8872051

Spain

Tel: 91-5774296

Fax: 91-5764966

Sweden

Tel: 0589-19250

Fax: 0589-16153

Singapore

Tel: 744-6873

Fax: 744-5971

Taiwan

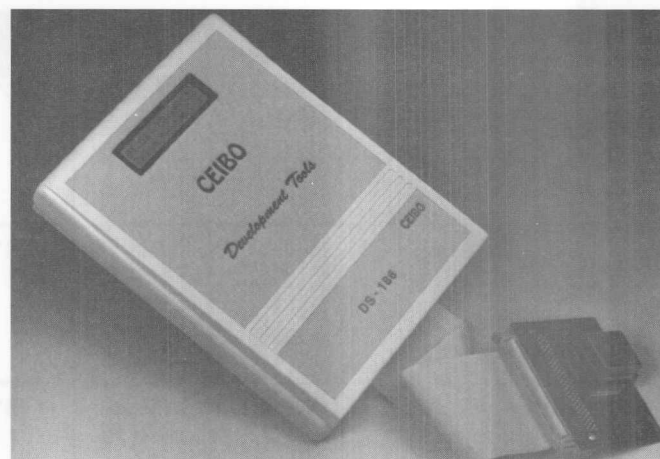
Tel: 02-9178773

Fax: 02-9126641

Other Countries Tel: +972-9-5615635 Fax: +972-9-553297

email, CompuServe 75131, 1415

Internet: 76131.1415@compuserve.com



### Product Information

Ceibo DS-186 is a real-time in-circuit emulator dedicated to the 80C186/80C188 family of microprocessors. The emulator provides a versatile and efficient tool for debugging, developing and manufacturing of systems designed with these microprocessors. DS-186 operates with an IBM PC or compatible computer through an RS 232 interface. The baud rate is programmable from 9600 Baud to 115K Baud. The software includes a state-of-the-art source-level debugger from Paradigm designed to support embedded system applications with the power and flexibility of the award-winning Turbo Debugger.

DS-186 provides 1M byte of zero wait state mapped memory. Memory can be mapped in boundaries of 1K byte. The system operates up to 30MHz. Emulation speed is limited by the maximum frequency of the microprocessor placed on the adapter.

DS-186 has the ability to set 1M hardware breakpoints. The program is executed until a specified breakpoint condition is reached. Breakpoints are qualified by instruction fetch, instruction execution, data contents, read/write from/to memory and I/O.

The Trace Buffer records 8K frames and with external triggers. The Trace display shows the source, assembler and bus cycles.

DS-186 accepts Intel OMF-86 and .EXE files. These files are converted by DS-186 utilities to absolute executable format. Assembler and High-Level-Language files supported by DS-186 are: Borland C++, Turbo C++, Turbo C, Microsoft C, Microsoft C++, Intel C-86, Intel PLM-86 and more. DS-186 also accepts files generated by Turbo Assembler, Microsoft Assembler and ASM86.

### Support

DS-186 uses standard microprocessors for hardware and software emulation. You can select a different microprocessor by replacing the microprocessor in the adapter or changing the adapter. The system runs at the frequency of the crystal on the adapter or from your hardware clock source. The AD-186 adapter supports 80C186, 80C188, 80C186XL, 80C188XL, 80C186EA, and 80C188EA. Other adapters are available to emulate the 80C186/8/EB, 80C186/8/EC.

# CEIBO



## CheckMate-C186/88™

## CheckMate™ Emulators

- ▲ Supports all versions of 80C186 & 80C188 XL and E-Series, 5V and 3V
- ▲ 20 MHz operation standard/25 MHz optional
- ▲ Patented emulator technology
- ▲ 10M bits per second communication speed standard
- ▲ Plug-in and run operation, fully supports Intel's ONCE mode
- ▲ Does not use target ADDR or I/O space, target interrupts or stack space
- ▲ Paradigm DEBUG™ source level debug interface standard
- ▲ Complete hardware event system has 4 groups with 32 ADDR, 16 DATA, STATUS (including DMA and Interrupt acknowledge), 16-bit event counter, and 8 external logic state inputs (LSI)
- ▲ 16K (256K optional) trace memory fully qualified by hardware event system. Includes LSI and timestamp
- ▲ 256K overlay memory standard (Optional 1024K byte)
- ▲ PC/AT or above hosted ISA/Microchannel/PCMCIA Bus support

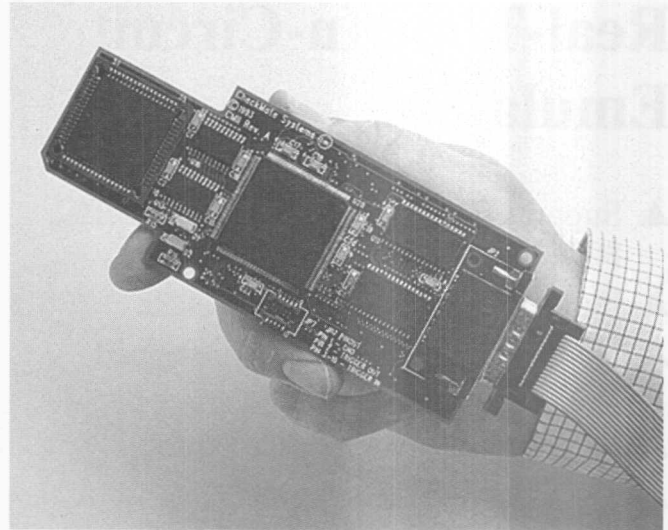
**Contact Information**

CheckMate Systems  
 8581 154th Ave. NE  
 Redmond, WA 98052  
 Tel: (206) 869-7211  
 Fax: (206) 861-3647

For International contacts see page 157.



**CheckMate Systems™**

**Source Level Debug Environment**

CheckMate-C186™ comes complete with Paradigm DEBUG, the industry standard, source level debugger interface you demand. Our entire emulator feature set is available directly in the debug environment.

**Rich Feature Set Includes****Hardware Bus Event System and Breakpoints**

The Hardware Bus Event System consists of 4 groups or levels each containing 8 ADDRess, 4 DATA, and STATUS comparitors coupled to 8 LSI external trigger inputs and a 16-bit hardware event counter.

The actions available are to break evaluation, jump forward or backward to another Group, Trace on/off or Single Cycle, Increment/Reset counter or Trigger out.

In addition, an unlimited number of ADDRess only execution Breakpoints are available.

**Trace Memory**

The 16K trace buffer captures all ADDR, DATA, STATUS information, along with a 16-bit timestamp and the 8-bits of Logic State Inputs (LSI). Trace is fully qualified by the Bus Event System and it can also be PRE, POST, and MIDDLE trigger. 256K trace buffer is optional.

**Overlay RAM**

Overlay memory comes standard with 256K bytes and it may be mapped across the entire target address space on 1K boundaries. This memory is 0 wait-state at 25 MHz target clock operation. 1024K bytes overlay is optional.

**Ordering Information**

Contact factory for pricing.

## Real-Time In-Circuit Emulator

- ▲ Support for 80C186/8/XL/EA/EB/EC, 8086/8 and other derivatives
- ▲ Full speed emulation to 30 MHz
- ▲ Up to 1MB zero wait-state mapped memory
- ▲ 8K frames dynamic trace buffer
- ▲ 1M hardware breakpoints
- ▲ Numeric coprocessor support
- ▲ Support for Borland, Microsoft® and Intel Compilers
- ▲ Full C, C++ Pascal and assembler expression evaluation
- ▲ Paradigm DEBUG, LOCATE, and OMFCVT software included
- ▲ 24-hour, 7-day, post-sale support
- ▲ 14-day evaluation period

### Contact Information

Emulation Technology, Inc.  
2344 Walsh Avenue, Bldg. F  
Santa Clara, CA 95051  
Tel: (408) 982-0660  
Fax: (408) 982-0664

Call ET Headquarters for International Sales offices.  
Ask about our 16-bit emulators, logic analyzers, universal programmers, simulators, digital storage oscilloscopes, software, and adapters.



EMULATION TECHNOLOGY, INC.



### Product Information

The ET-iC186 is a real-time in-circuit emulator dedicated to the 80C186/80C188 family of microprocessors. Different derivatives are supported with a pod change. The baud rate is programmable from 9600 baud to 115K baud. The software includes a source-level debugger from Paradigm that supports embedded system applications with the power and flexibility of the award-winning Turbo Debugger (a \$1,000 value).

### Processors Supported

80C186, 80C188, 80C186XL, 80188XL, 80C186EA, 80C188EA, 80C186EB, 80C188EB, 80C186EC, 80C188EC, 8086, 8088, 80C86, 80C88.

### Host Systems Supported

IBM PC or Compatibles with 512K of RAM, one RS 232C interface card, PC-DOS 3.0 or later.

### Languages and File Formats

Assembler/high-level language support. Accepts Intel OMF-86 and .EXE files.

### Supported Compilers and Assemblers

Borland C++, Turbo C++, Turbo C, Microsoft® C, Microsoft C++, Intel C-86, Intel PLM-86, also accepts files generated by Turbo Assembler, Microsoft Assembler and ASM86.

### Ordering Information

The ET-iC186 emulator comes complete with base unit, 1M breakpoints, 256KB of emulation memory, Paradigm DEBUG, LOCATE, and OMFCVT software, external power supply, RS 232 PC interface cable, and user manual. Adapters are available for all pod to target interconnections. Pricing starts at \$3,600. Optional 1MB memory expansion, trace module. Wide range of personality modules available.

## HP 1660/HP 16500B

## HP 1660-Series Logic Analyzers

Get to the root of your problems quickly with these desktop logic analyzers.

- ▲ Resolve time intervals as short as 2 ns and find elusive glitches with 5 timing analysis modes
- ▲ Get an analog view of critical signals with an integrated 2-channel, 1-GSa/s oscilloscope
- ▲ Display disassembled code listings with low-profile, low-capacitance interfaces for Intel 80186 family processors
- ▲ Integrate code flow, timing waveforms, and oscilloscope waveforms into a single display
- ▲ Focus on the problem with fast, intuitive operation using the graphical human interface
- ▲ Document your work using standard file types and the built-in 3.5" floppy disk

## HP 16500B Logic Analysis System

All the same features as the HP 1660 analyzers plus modularity, color touchscreen interface and LAN.

- ▲ Configure up to 340 channels on the same time base for 500-MSa/s timing/110 MHz state
- ▲ Easily display high-level symbol and source line information correlating bus-level data with application source code using the B3740A Software Analyzer
- ▲ Move data to your workstation or PC with the HP 16500L Ethernet LAN interface card or store files locally on the standard 270M byte hard drive
- ▲ Replace missing system components with the HP 16520A and 16521A pattern generation modules
- ▲ Grow beyond the 5 module slots in an HP 500B with an HP 16501A expander frame



### Product Information

Hewlett-Packard logic analyzers cover a broad application range. You can verify functionality and troubleshoot problems at hardware turn-on with timing analysis and integrated oscilloscope capabilities.

Simply use cross-domain analysis techniques when you aren't sure whether a problem is in the hardware or the software. For example, pinpoint hard-to-find problems and show their effects by integrating the display of code flow with timing and analog data. And, troubleshoot software during real-time operation using advanced inverse assembly and links to symbolics in your language system.

### Processors Supported

80C186/80C188PGA PLCC	E2434A
80C186EA/80C188EA PLCC	E2434A
80C186XL/80C188XL PGA.PLCC	E2434A
80C186XL/80C188XL QFP	E2434A#1CC
80186EB/80C188EB PLCC	E2434B
80C186EB/80C188EB QFP	E2434B#1CC
80C186EC/80C188EC	E2434C

(Choose one of the following adapters):

100-pin rectangular QFP adapter	E3424A
100-pin square QFP adapter	E3432A

### HP Product Number

### Contact Information

Hewlett-Packard Company  
Fullerton, CA (714) 999-6700  
Atlanta, GA (404) 955-1500

### International Contacts

Canada (905) 206-4725  
Europe 020 547-6222  
Japan (81) 426 48 3860  
Far East (852) 2599-7070



## HP 64767-Series

## Emulator for Intel 80C186E-Series Processors

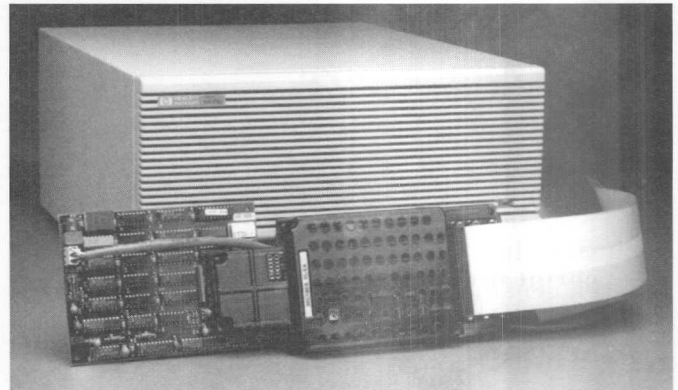
- ▲ Emulation support for the entire 80C186E-series family (EA, EB, EC, XL & Low Voltage parts) and compatibility for older 80C186 and 80186 designs
- ▲ Debugger interfaces and operation on HP 9000s, Sun SPARCstations, or PCs via RS-232, RS-422, or LAN interconnections
- ▲ Real-time, zero wait state operation to target or emulation memory to 20 MHz
- ▲ Active probe includes 1 megabyte of emulation memory that covers the entire address space of the processor
- ▲ All emulation memory is fully dual ported in 16 mappable blocks with 1K byte resolution
- ▲ Support for all the popular pin-out packages, including surface mount designs
- ▲ Full symbolic debug support for fast, easy development and debug with HP user interfaces
- ▲ Eight hardware and 32 software breakpoints in conjunction with an internal emulation bus analyzer, available in 1K, 8K, 64K, and 256K trace depths
- ▲ Real-time analysis of address, data, and status/control information in conjunction with instruction dequeuing of the trace list
- ▲ Symbols and line numbers inserted in the trace list for quick understanding of the code's execution
- ▲ The system includes background and foreground monitors to display and modify registers, peripheral control block, and target or emulation memory

### Contact Information

In the U.S., call (800) 447-3282 for the location of the HP 64000 sales office; for the rest of the world, call the local HP sales office or fax your request to (719) 590-5054



**HEWLETT<sup>®</sup>  
PACKARD**



### Product Information

The HP 64767A/B/C active probe emulators support a broad selection of the Intel 80C186/188 family of microprocessors. These emulators support the entire 80C186E-series family as well as low voltage and the 80C186 and 80186 versions. Designers selecting these Intel 16-bit microprocessors are assured of a full line of support with modular tools and software on a wide range of design platforms.

These emulators have active probes to ensure maximum electrical transparency. Active probing permits the use of long 914-mm (36-inch) cables for easy target system access. The emulation probes contain the microprocessor, emulation monitor, run-control circuits, and 1M byte of emulation memory. The emulators include background or foreground monitors. Extensive breakpoint capabilities allow flexibility in starting and stopping execution of the code.

Emulation control and emulation bus analyzer cards plug into a modular card cage that connects to the host via RS-232, RS-422, or LAN. Easy-to-use interfaces are available for HP 9000 series work-stations and Sun SPARCstations. A windows-based real-time C debugger interface is available for designers using PCs.

For software development, the HP 64767 emulators are supported by the HP embedded debug environment and the HP advanced cross-language system on HP and Sun workstations. The debug environment offers a complete suite of software development and measurement tools to assist in producing high-quality, on-time, specification-compliant code. The debug environment is compatible with the industry's leading language systems for C, C++, and real-time operating systems.

### Ordering Information

- 64767A Active Probe Emulator with 1M byte of memory for 80C186EA/XL processors with demo board, PGA and PLCC adapters (647674L for low voltage)
- 64767B Active Probe Emulator with 1M byte of memory for 80C186EB processors with demo board and PLCC adapters (64767BL for low voltage)
- 64767C Active Probe Emulator with 1M byte of memory for 80C186EC processors with demo board and PQFP adapters (64767CL for low voltage)

Note: Card cage, emulation control, and emulation bus analyzers are ordered separately.



## 80C188 Single Board Computers

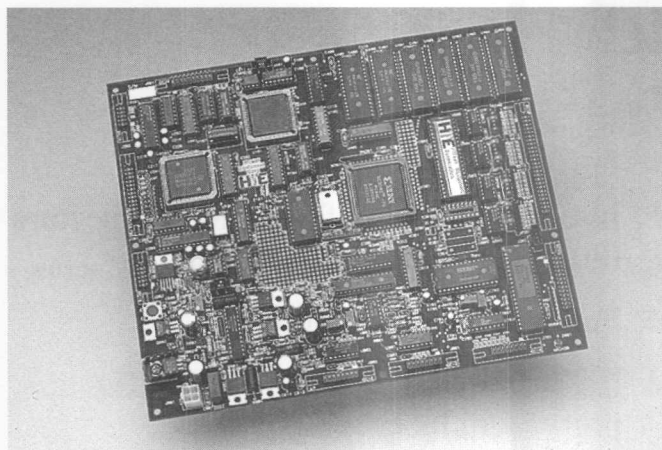
- ▲ Intel 80C188XL or EA, 16 or 20 MHz
- ▲ 2 serial ports, RS232 or 485, 1 Parallel Centronics style

### 188SBC:

- ▲ Up to 768K bytes battery backed SRAM, up to 256K bytes Flash EROM or EPROM; 6-32 pin sockets
- ▲ 16 channel, 12 bit A/D and 8 channel, 12 bit D/A
- ▲ LCD interface, 24 bit Digital I/O or SS Relay interface, 20 bits more for Keyboard or I/O
- ▲ Battery-Backed Real-Time Clock; On-board power supply with power fail interrupt
- ▲ PC/104 bus expansion interface for PCMCIA and LAN peripherals
- ▲ On-board FPGA for custom interfaces

### 188STD:

- ▲ Up to 512K bytes battery backed SRAM, up to 256K bytes Flash EROM and EPROM; 4-32 pin sockets
- ▲ Real-time clock, battery-backed, power fail interrupt
- ▲ LCD & keyboard matrix interface ports
- ▲ PCMCIA 2.0 interface
- ▲ IEEE-488 interface
- ▲ STD Bus Compatible



### Product Information

The 188SBC Development Board is a stand-alone single board computer, ready to go to work right out of the box. It offers many features to satisfy your complex control requirements, including a 16 channel, 12- or 16-bit A/D converter, an eight channel, 12-bit D/A, and 44 bits of digital I/O. Two RS 232 or 485 serial ports, a parallel port, real-time clock, fully static, battery backed RAM and Flash programming ability are standard. Expand to PCMCIA or LAN through the PC/104 standard ISA bus. An optional Field Programmable Gate Array (up to 9000 gates) allows you to design the custom circuitry you need to get that difficult project done.

The 188STD is an STD bus card with up to 256K bytes of Flash EROM, 256K bytes of UVEPROM and 512K bytes of Static RAM. Included is an on-board Flash programmer. Besides two serial and one parallel ports, there are a real-time clock and LCD and keyboard interfaces. This card includes a PCMCIA 2.0 card and IEEE-488 interfaces. Nearly any desired system can be built using the 188STD and STD bus compatible peripheral cards.

And these new product offerings get you to market with your controller design even faster! Develop code right on your PC using Borland or Microsoft® language tools. Then use the Borland-style development interface from Paradigm to download and test code operation at the source code level. Simple! OEM and custom versions of both cards are available.

### Ordering Information

Call for price and availability, or use our Internet ftp server to receive brochures.

### Contact Information

HiTech Equipment Corporation  
9400 Activity Road  
San Diego, CA 92126  
Tel: (619) 566-1892  
Fax: (619) 530-1458  
email: Compuserve 70662,1241  
Internet sales@hte.com  
ftp server: ftp.hte.com

## teletest 16 In-Circuit Emulators

- ▲ In-circuit emulator for 80186 architecture (80186/80188/XL/EA/EB/EC)
- ▲ Full low voltage support
- ▲ Real-time emulation up to 20 MHz processor clock
- ▲ No wait states or target-system restrictions
- ▲ Emulation memory up to 1MB
- ▲ Two independent trace buffers
- ▲ 8 hardware break/trigger registers
- ▲ Real-time, delay and event counters
- ▲ SAA-oriented user interface
- ▲ Enhanced HLL-debugging facilities
- ▲ Serial and parallel link to the host
- ▲ Performance analysis (optional)

### Contact Information

HiTOOLS Inc.  
2055 Gateway Place  
Suite 400  
San Jose, California 95110  
Tel: (408) 451-3986  
Fax: (408) 441-9486

Hitex GmbH  
Greschbachstr. 12  
76229 Karlsruhe  
Germany  
Tel: (0721) 96 280  
Fax: (0721) 96 218 49



### Product Information

The teletest 16 in-circuit emulator is a modular system for testing 80x86 applications. The system offers powerful support not only for the 80C86/88 and 80C286 microcontrollers, but also for all 80186/188 microprocessors up to a maximum frequency of 20 MHz (processor clock). The teletest 16 operates without using any target-system resources or wait states, thus offering transparent real-time emulation. The system consists of a basic unit with power supply (110/235 V), emulation memory, two trace buffers, the trigger logic, as well as an emulation pod for the processor-specific features. The EP186 emulation pods support all variants of the 80186 microcontroller family inserting the appropriate processor into the corresponding socket located on the pod.

The teletest 16 system uses the SAA-standard HiTOP operating software, the interactive software for tried and tested Hitex in-circuit emulation systems. It allows full symbolic high-level language debugging for all development environments that generate Intel-OMF as well as Microsoft and Borland tools. HiTOP provides an extremely user friendly interface that is tailored to the requirements of 80x86 development work. Over 2,500 teletest 16 emulators have been installed, and users testify to the powerful features, accuracy, and reliability of the teletest 16 in-circuit emulation system for complex embedded applications.

# hitex

# Innovage 2000

## Microprocessor System Board Tester

- ▲ Advanced "ATE" troubleshooting tool
- ▲ Digital test features
- ▲ Bench top based central unit
- ▲ Interchangeable microprocessor interfaces
- ▲ Three-state synchronized digital probe
- ▲ Powerful flexible FPGA logic
- ▲ Stand alone or remote usage
- ▲ Upgradability via Flash Memory
- ▲ Supports Intel 8-, 16-, 32-bit microprocessors



### Product Information

In today's fast paced world of test and measurement, the Innovage 2000 stands above the competition. By utilizing static memory based LCA's (Logic Cell Arrays) and Flash Memory, the customer can be assured that their instrument will never be outdated or obsolete. An added benefit of the LCA's on the fly reconfigurability is that more functionality can be pressed into a smaller portable package, unlike the competitor's large bulky test systems.

The Innovage 2000 has a multitude of built-in tests to check the functionality of the UUT (Unit Under Test). The "Bus Test" checks the drivability (i.e. shorts or stuck bits) of the UUT's kernel. The "Memory Tests" allow the writing and reading of memory devices. I/O Tests allow access to devices that reside in the I/O map of microprocessors that support separate Memory and I/O maps. The Innovage 2000 has a unique set of Probe Tests that allow its synchronized probe under QuickTrace™ to independently identify signals when the probe touches a nodal point.

Another set of features that the Innovage 2000 offers is Breakpoint, Framepoint™ and External Trigger. The Breakpoint and Framepoint functions allow the instrument to display trace address and data information of where and how the UUT is executing. The External Trigger function is used in conjunction with a logic analyzer and/or oscilloscope to generate a trigger pulse when a condition is met.

### Contact Information

Innovage Technologies, Inc.  
 #210, 239 Midpark Way SE  
 Calgary, Alberta T2X 1M2  
 Tel: (800) 463-4997  
 Tel: (403) 254-2205  
 Fax: (403) 254-2935

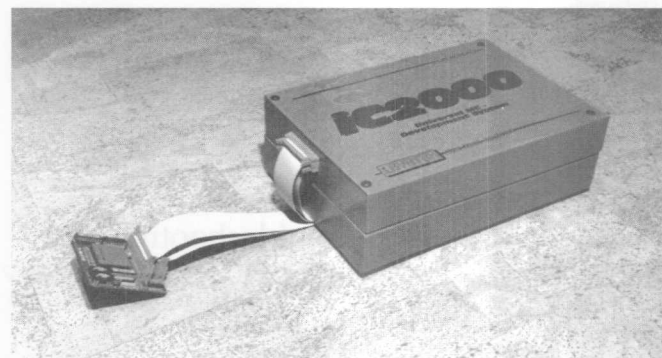


## iC2000 Power-Emulator for 8-, 16-, and 32-bit

- ▲ Wide range of 80C186 family support
- ▲ Integrated Development Environment
- ▲ Real-time emulation up to 33 MHz
- ▲ Overlay memory up to 16M byte
- ▲ Real-time breakpoints up to 16M byte
- ▲ Three breakpoint pass counters 16-bit
- ▲ Data bus 8- or 16-bit/address bus 32-bit
- ▲ Background interrupt/DMA mode
- ▲ 32K 96-bit trace module
- ▲ Logic analyzer module
- ▲ Integrated 8-channel wave form generator
- ▲ Programmable oscillator up to 100 MHz
- ▲ Real-time watch and modify
- ▲ Code coverage and call stack monitor
- ▲ DOS and Windows™ user interface
- ▲ High speed PC link (COM, LPT, iBIT)

### Contact Information

iSYSTEM GmbH  
Einsteinstr. 5 - D-85221 Dachau - Germany  
Tel: +49(8131)25083  
Fax: +49(8131)14024  
Modem: +49(8131)1687  
ISDN: +49(8131)53502  
Compuserve: 100020,470



### Product Information

The iC2000 Power-Emulator for 8-, 16-, and 32-bit applications is a high performance real-time development system supporting the 80C186 microprocessor families. It provides an optimized, integrated environment for hard and software development to shorten development cycle and to increase the productivity dramatically.

The Integrated Development Environment (IDE) is available for DOS and Windows. It includes a project manager, a multi-file C source color editor and a high-level source debugger.

The flexible interface to third party compilers, assemblers and linkers gives the possibility to run these tools automatically from inside the IDE using the powerful MAKE and BUILD functions. All options for these tools can be set from within a dialog box.

The perfect combination and integration of all development tools in one powerful environment speeds up the development cycle extremely.

iC2000 with the powerful Trace, the Profiler and the integrated logic analyzer are the right tools to get your product in-time to the market, to optimize the performance and to secure the quality of your application.

### Processors Supported

iC2000 is supporting currently more than 130 microcontrollers. The flexible design of iC2000 allows us to support a wide range of microcontrollers using standard and "Bond-Out" chips. We add support for new chips and families continuously. Please contact your iC2000 vendor for latest information.

### Host Systems Supported

PC Platform

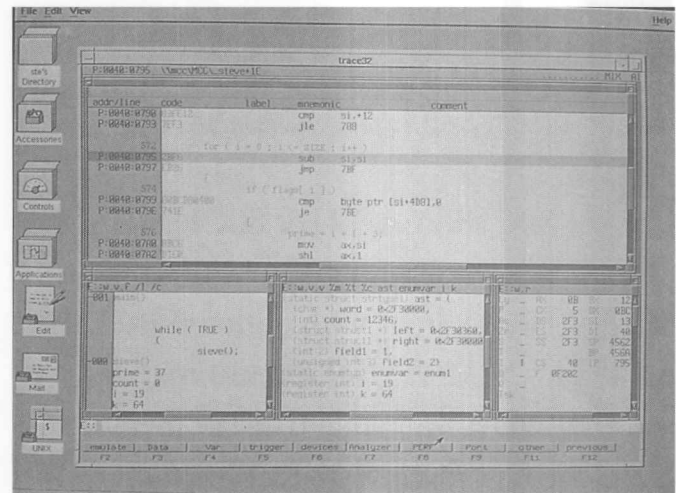
### Ordering Information

iC2000 starts at \$4,400. US. Please contact our main office to get the address of our distributor in your country. Complete info package and demo diskette are available for free. You can download the latest demo software, technical and pricing information or latest software updates and manuals from our BBS. You can access our BBS via Modem or ISDN.



## In-Circuit Emulator for Intel 80C186-Series Processors

- ▲ Universal In-Circuit Emulator for 8- to 32-bit microprocessors
- ▲ Unlimited hardware breakpoints
- ▲ Up to 16M byte dual-ported emulation memory
- ▲ High-speed link via ethernet LAN or fiber optic
- ▲ Up to 4M frame trace buffer
- ▲ Real-time trace and trigger up to 25 MHz
- ▲ Integrated high-level language debugger supports: Intel, Borland, Intermetrics, Microsoft®, & Microtec
- ▲ Multi task debugger
- ▲ Performance analysis and statistic functions
- ▲ Available for PC, SUN-, DEC-, VAX-, HP-Workstation
- ▲ Support for 186, C186, C186XL, C186EA, C186EB, C186EC, 188, C188, C188XL, C188EA, C188EB, C188EC
- ▲ Also supports the following Intel microprocessor & microcontroller families: 80C386/486, 8086, 80196, 8051
- ▲ Timing-analyzer with pattern generator and line tester



### Product Information

The TRACE32 provides a complete set of development and testing tools. The advanced modularity of TRACE32 makes it very easy to upgrade the system to future needs. By adding or changing personality modules another microprocessor or a new feature can be supported.

The TRACE32 has more interfaces to PCs and workstations than any other system. The communication link to the host is done by the fiber optic interface or Ethernet allowing a high-speed transfer. Other standard interfaces such as SCSI, RS-232, RS-422 and a low-cost parallel connection are also supported. As software drivers available for most systems, it is possible to share a TRACE32 in a LAN of PCs and workstations.

The integrated HLL Debugger with its powerful trigger and trace capabilities supports multi task kernels as well as real-time systems, interrupts can be served at any time during single-step emulation (Ada, C, C++, Modula 2, Pascal, PL/M and assembly languages supported.)

The analyzer offers selective state trace as well as software performance analysis and statistic functions.

The comfortable windowed interface is completely configurable by the user. No other system offers more flexibility. With its powerful printer interface, hard copies of windows or screens can be made in text or graphic form.

The testing language, PRACTICE-II, with its macro concept can be used for automatic hardware and software test routines.

### Contact Information

Lauterbach Datentechnik GmbH  
Fichtenstr. 27  
D-85649 Hofolding  
Germany  
Tel: (08104) 8943-0  
Fax: (08104) 8943-49

Lauterbach Inc.  
945 Concord Street  
Framingham, MA 01701  
Tel: (508) 620-4521  
Fax: (508) 620-4522

## MICE-IIIS-80C186

## MICE-IIIS-80C186 In-Circuit Emulator

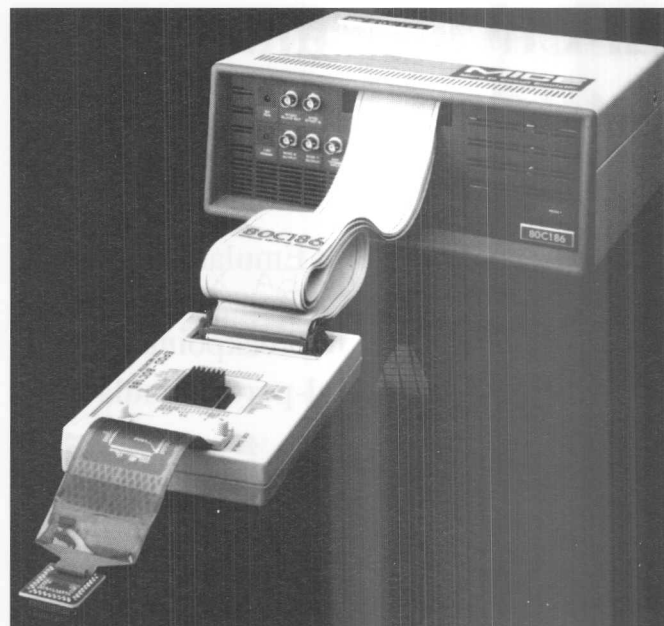
- ▲ 5 V 80C186/EA/XL or 80C188/EA/XL
- ▲ 3 V 80L186EA8 or 80L188EA8
- ▲ 5 V 80C186/EB with optional package
- ▲ Up to 20 MHz, 100% real-time
- ▲ 1MB zero wait state overlay memory
- ▲ Choice of hyperSOURCE-186 or Paradigm DEBUG/MICE-IIIS source language debuggers
- ▲ High speed parallel interface
- ▲ 32K trace with 100ns timestamp
- ▲ True hardware execution breakpoints
- ▲ 4 addr/data/status/counter bus breakpoints
- ▲ Trigger and trace without stopping emulation

### Contact Information

Microtek International, Inc.  
3300 N.W. 211th Terrace  
Hillsboro, OR 97124  
Tel: (503) 645-7333 Technical Support  
Tel: (800) 886-7333 Sales information  
Fax: (503) 629-8460

# MICROTEK

The Leader in Development Systems Technology™



### Product Information

The MICE-IIIS- 80C186 supports full-featured in-circuit emulation at the low cost of lesser solutions. For example, you can change triggering, capture and display while the target runs full speed at 20 MHz with zero wait states.

The large 32K frame trace buffer triggers display on four logical bus events with eight sequential levels that you can define on address, data status and logic probes. Display includes 100 nanosecond timestamp with pre/center/post-trigger view options. Three execution breakpoints break on EXECUTED instructions, not just pre-fetches.

You also get more control of your system. You can map one megabyte of overlay into 4K segments, without changing jumpers. Or enable processor control signals, including INTx, NMI, DRQx, Reset, Preq and HOLD from the keyboard.

The small 1.2" x 1.2" x 0.3" probe drains no target power. The same emulator supports both 3 volt and 5 volt emulation.

Choose your high-level language interface. Paradigm DEBUG/MICE-IIIS features the familiar Turbo C interface and includes OMFCVT and LOCATE at no extra cost. HyperSOURCE-186 was optimized for MICEIIIS. USDIII is included with every system to support symbolic assembly debug.

### Host Systems Supported, Processors Supported

Requires 386 PC with 4M extended memory, VGA display, MS-DOS 3.3 or 5.0, and 2M free disk space.

### Ordering Information

Call for configurations. Microtek also supplies in-circuit emulation for other Intel microprocessors, including 8086, 80286, Intel386™ EX, CX, SX and DX, Intel486™ and the Pentium® microprocessors.

## Universal In-Circuit Emulator

- ▲ Transparent in-circuit Emulation
- ▲ Supports 80C186/88 EA, XL, EB, EC and 8086/88
- ▲ ONCE mode support
- ▲ Up to 2MB of emulation memory
- ▲ Powerful hardware breakpoints
- ▲ Complex trigger & break system
- ▲ 32K by 88-bit time-stamped trace
- ▲ High speed fiber optic interface
- ▲ Paradigm's DEBUG/Noral high level debugging support

### Contact Information

Noral Micrologics Limited  
 Logic House, Gate Street  
 Blackburn, Lancashire UK. BB1 3AQ  
 Tel: INT+44+1254+682092  
 Fax: INT+44+1254+680847



The Emulation Experts



### Product Information

Noral's SDT-Xi range of universal in-circuit emulators supports a wide range of 8- and 16-bit CPUs including Intel's 80186/88 family of devices. Low cost emulation pods and probes provide cost effective upgrade paths when target system design changes introduce new microprocessors.

SDT-Xi emulators include an advanced hardware breakpoint system, up to 2MB of OWS emulation memory, an event detect and sequencing system, a 32K by 88 bit, 50 nsec time stamped trace buffer, trace buffer input filtering, an address violation detection system and many other features essential for complex debugging procedures. Several software options are available including Prism, Noral's universal debugger and Paradigm's DEBUG/Noral, a high level debugger for 80186 family devices.

Also available from Noral is Lauterbach's powerful Trace32 in-circuit emulator with support for a wide range of 8, 16 and 32 bit microprocessors. Trace32 includes support for Intel's 80186, 80386, 80486, 80196 and 8051 processor families.

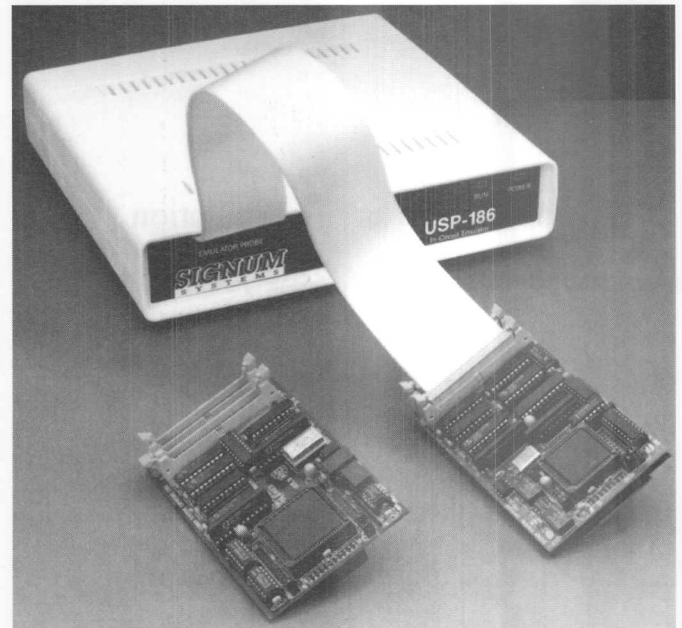
## 80186 Family In-Circuit Emulator

- ▲ 1MB of dual-ported zero wait state emulation memory allows read & write access during execution
- ▲ Non-intrusive emulation up to 64 MHz (crystal)
- ▲ Emulates 188, 186, XL, EA, EB, EC (5V and 3V support)
- ▲ HLL debugging for C and C++
- ▲ 32K by 80-bit selective trace buffer
- ▲ 32-bit synchronized time stamp in trace
- ▲ Complex hardware breakpoints and passpoints
- ▲ Unlimited address and data match breakpoints
- ▲ Software performance analysis
- ▲ Execution coverage monitor displays map of all locations executed, read, and written
- ▲ Macros for automated board testing
- ▲ High speed serial interface to a PC host (no plug-in cards)
- ▲ Windows™ and MS-DOS user interface

### Contact Information

Signum Systems  
171 E. Thousand Oaks Blvd., #202  
Thousand Oaks, CA 91360  
Tel: (800) 838-8012  
Tel: (805) 371-4608  
Fax: (805) 371-4610

**SIGNUM**  
SYSTEMS



### Product Information

USP-186 gives true real-time in-circuit development and debugging in machine code and High Level Language (HLL) modes.

USP-186 comes complete with 1MB of memory, C/C++ and ASM debugger, 80 bit wide by 32K deep trace, and a sophisticated Event Triggering System that uses a combination of address match comparators, data match comparators, sequencer, external probes, and pass counters to create almost any complex trigger condition.

Equipped with 1MB of zero wait state, dual-ported memory, the emulator allows reading and writing to its memory while the processor is running in real-time. Watching and modification of variables and parameters may be done without stopping the processor and waiting for the motors or systems to stabilize each time. You can watch variables change on-the-fly, and zoom in on any member of a complex structure with a click of a mouse.

Selective tracing of only meaningful data is easily achieved with the aid of the Event Triggering System. A 32-bit time stamp, synchronized to the processor clock, shows exact time relationships between instructions and routines, in absolute or relative display modes.

The HLL debugger provides support for Intel, Microsoft, and Borland compilers. Unlimited number of breakpoints and passpoints may be set or cleared with a mouse, by simply clicking on the desired instruction in the Source window.

Emulation CPU (either bondout or standard) is mounted on probe assembly, as close as possible to target system for the best possible emulation.

### Other products

Signum carries a full line of emulators for 80C51, 196, 186, 386, 486.

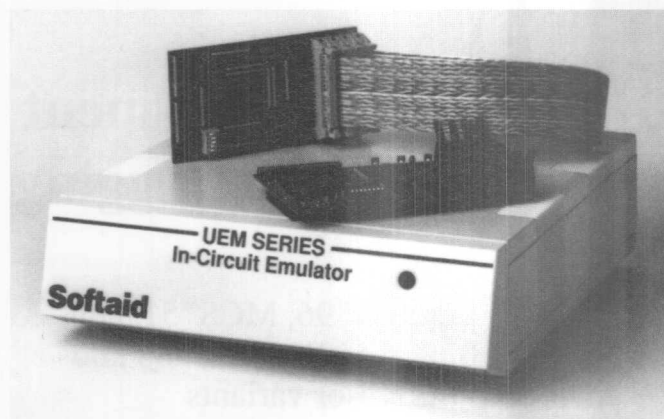


## UEM Emulator

- ▲ Supports all versions of the 80186/188
- ▲ Supports the Intel386™EX embedded processor via a pod swap
- ▲ Includes Windows™ and DOS Source Debuggers
- ▲ 256K to 1MB emulation RAM
- ▲ 1 million hardware breakpoints
- ▲ 8 real-time bus match break/trigger points
- ▲ 32K deep trace
- ▲ Time stamping
- ▲ Performance analysis
- ▲ 16 to 25 MHz operation
- ▲ Runs with or without a target system

### Contact Information

Softaid, Inc.  
 8310 Guilford Road  
 Columbia, MD 21046  
 Tel: (800) 433-8812  
 Tel: (410) 290-7760  
 Fax: (410) 381-3253  
 Web: <http://www.softaid.com/pub/jganssle>



### Product Information

The UEM's offer complete, non-intrusive software development. Softaid's UEM-186 emulators give you the industry's most complete support of your 8- and 16-bit development projects. The UEM comes complete with both Windows and DOS source level debuggers that handle any compiler.

Count 'em: 1 million hardware breakpoints, that run at full speed in ROM or in RAM. Need more power? The UEM includes 8 breakpoints/trigger points that match the complete bus — address, data, cycle type, external inputs — all in real-time. "Don't care" bits and greater-than/less-than comparisons support conditions like "break if the data at foo\_bar is >1000 and < 1103".

The UEM's very deep trace insures you'll collect the most obscure bugs. Qualify trace collection to limit what goes into the buffer. Control trace start and stop using any trigger point. You can even retrigger trace to collect multiple snapshots of the same event. Start, stop, and examine trace all without slowing your code. Every trace cycle includes a time stamp with variable prescaler so you know exactly when each event occurs.

Find code bottlenecks with the performance analyzer, which tracks up to 255 events, all in real-time. Display histograms of code activity on a function-by-function basis. In addition, a timer continuously displays elapsed time between two event triggers.

A single emulator supports all 186 and 188 variants, including the EA, XL, EB, and EC. You can even support the Intel386™EX processor via a simple pod swap.

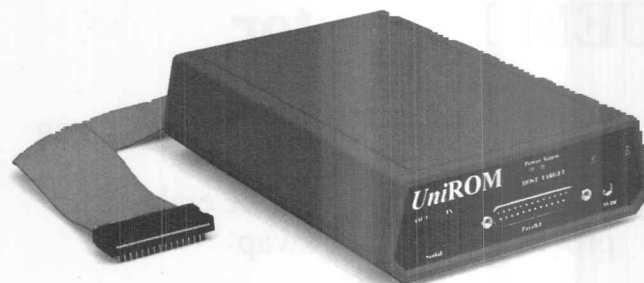
# Softaid

## UniROM- Hardware Enhancement for Firmware Debugging

- ▲ Supports all MCS® 96, MCS® 51, and MCS® 251 microcontrollers, and x86 embedded processor variants
- ▲ No custom processor PODS
- ▲ A single configuration supports ALL processor speeds and package styles
- ▲ Hardware, software and firmware breakpoints
- ▲ Transparent, real-time debugging at full system speed
- ▲ Real-time watches
- ▲ FAST parallel and serial interfaces standard
- ▲ Memory emulation down to 35ns
- ▲ Up to 4M bytes of emulation memory
- ▲ Debug firmware in ROM space
- ▲ Trace memory option

### Contact Information

TechTools  
P.O. Box 462101  
Garland, TX 75046-2101  
Tel: (214) 272-9392  
Fax: (214) 494-5814



### Product Information

TechTools' UniROM provides a low cost alternative to a traditional ICE for firmware development. UniROM combines the strengths of a software based debugger with those of a hardware ICE, while eliminating their individual disadvantages.

A fully DUAL-PORTED memory architecture gives UniROM full access for REAL-TIME watches and for setting breakpoints without target assistance or impact. Firmware breakpoints (software execution breakpoint in ROM) combines the advantages of software breakpoints with those of hardware breakpoints. Firmware breakpoints work in ROM space but are not fooled by pre-fetch queues or caches.

UniROM uses a memory socket interface, eliminating the need for processor pods and overlay memory. This approach allows UniROM to work with all processor speeds, packages styles and other variants.

Code is debugged "IN-PLACE" for accurate results. Requires NO target resources or additional connections.

A TRACE board option adds a 32K deep trace buffer, complex trigger capabilities and hardware breakpoints.

UniROM is available bundled with a full featured PC-based, Source level DEBUGGER, or can be purchased separately and used with virtually any debugger or monitor program.

### Ordering Information

Contact TechTools for pricing and configuration options.



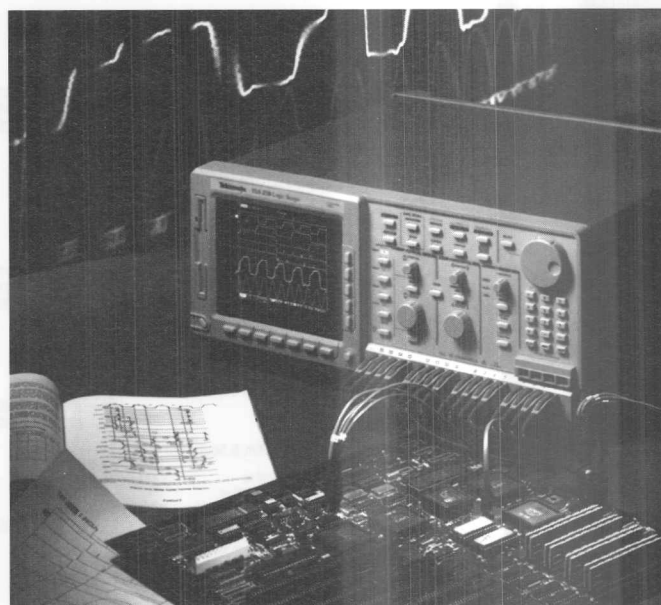
## TLS 216 Logic Scope

- ▲ 16 acquisition channels
- ▲ 2 GS/s simultaneous sampling across ALL channels
- ▲ 500 MHz real-time bandwidth
- ▲ +/- 100 pf timing accuracy across all channels
- ▲ 2.5 pF/1M-ohm podlet-style FET probes
- ▲ Sophisticated. Time-qualified triggering including four 16-bit word recognizers
- ▲ Time-correlated mixed-signal data display
- ▲ Internal 7-inch color monitor
- ▲ Internal 3-1/2-inch, 1.44MB MS-DOS compatible floppy disk drive
- ▲ Priced at \$26,500

### Contact Information

Tektronix, Inc.  
 P.O. Box 1520  
 703 West Housatonic Street  
 Pittsfield, MA 01202-9864  
 Tel: (800) 426-2200  
 Fax this page with your business card attached to  
 Fax: (413) 448-8003  
 WWW: <http://www.tek.com>

# Tektronix



### Product Information

The TLS 216 Logic Scope seamlessly combines the analog acquisition system of a high-speed digital storage oscilloscope (DSO) with the triggering and display systems of a logic analyzer in a single instrument. The 500 MHz, 2 GS/s TLS 216 addresses a wide range of applications, and is ideal for engineers debugging higher performance digital hardware typical of the computer, telecommunications, medical imaging, and computer peripheral industries. It also simplifies debugging hardware for moderate performance embedded systems such as engine, traffic or industrial control applications.

### Sophisticated Triggering to Identify Complex Digital Problems

In addition to edge, pulse, glitch and pattern triggering, the TLS 216 provides two new trigger resources which allow the instrument to directly trigger on common digital circuit behavior. The time interval or sequence trigger type monitors the time between two events allowing the instrument to directly trigger on common digital circuit behavior. The time interval or sequence trigger type monitors the time between two events allowing the instrument to easily trigger on setup-time violations, hold-time violations or unexpected propagation delay. The powerful "time out" trigger type can detect when an event is missing or does not complete. The "time out" trigger type can be used to capture incomplete hand-shake sequences or to trigger instruments when the DUT "hangs".

### Multiple Display Formats Simplify Problem Identification

The Logic Scope offers three display formats to simplify the process of identifying logic timing anomalies or violations. Acquired data can be displayed as either 8-bit analog waveforms, like a traditional DSO— or, as dual-threshold timing diagrams or as BusForms, similar to a logic analyzer.

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E-mail: "dgr"



# 8051

## In-Circuit Emulators

Microsoft Windows 3.1 based user interface

Pull-down Menus

Speed bar (point and click)

On line help

Source Window

Data Window

SFR's



Disassembler,  
in-line  
assembler  
Window

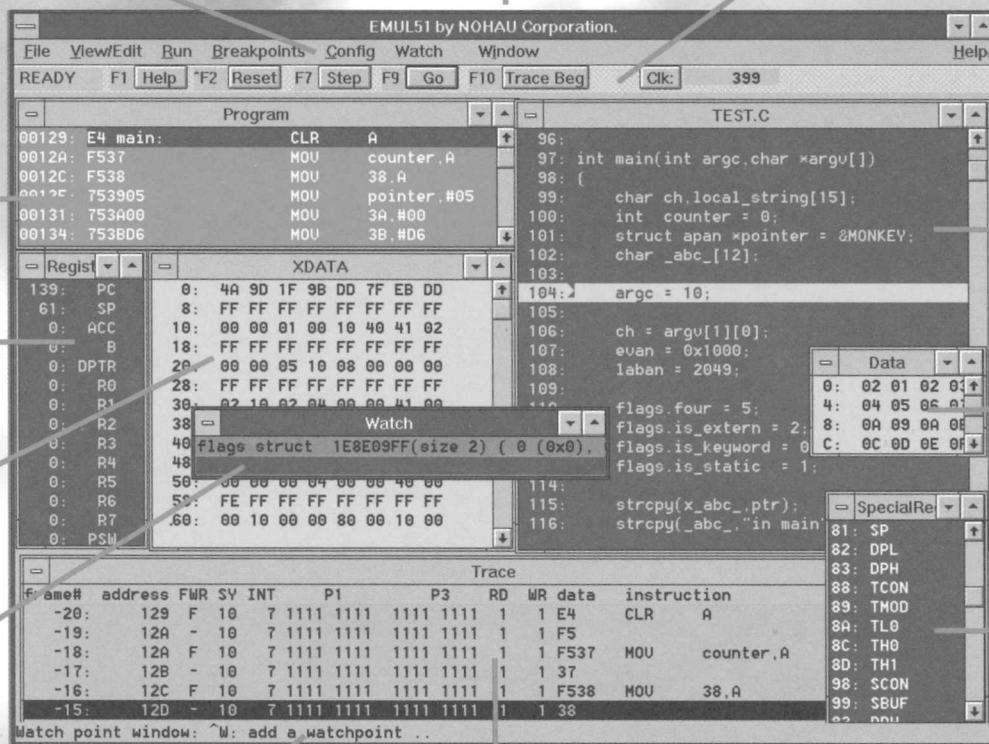
Register  
Window

XData  
Window

Watch  
Window  
for high level  
variables

Context sensitive help line

Trace Buffer Window



### FEATURES:

- Support for all 8051 derivatives.
- Real-time emulation up to 42MHz.
- Use of bond-out, hooks or regular chips for accurate emulation.
- Hosted on PC's and workstations.
- Choice of user interface:
  - a) Microsoft Windows or OS/2.
  - b) DOS based Borland keypress compatible (ChipView).
  - c) DOS based command line / pull-down windows.
  - d) Several third party interfaces.
- High Level support for popular C-compilers.
- Real-time trace boards, up to 256K deep, 64 bits wide, with eight trigger levels, timestamp and filtering.
- Unlimited breakpoints, bankswitch support, program performance analysis.

Also supported:

## 80C196

To learn more, please call (408) 866-1820 for a FREE Demo Disk. For more information via your Fax, call our 24-hour Information Center at (408) 378-2912.

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